



THE UTILITY OF RESEARCH ON BUILDING MATERIALS.

By ALAN E. MUNBY, M.A.Cantab. [F.].

Read before the Royal Institute of British Architects, Monday, 18th April 1921.

THOUGH the subject of my Paper is, I think, the outcome of suggestions made by our Science Standing Committee, the title is not of my choosing, and as I am not quite sure whether it carries a note of interrogation or whether, the utility of research being agreed, I am merely expected to elaborate the subject, it is perhaps necessary to begin by discussing what part and lot, in a present-day practice, the architect has in dealing with materials from a scientific aspect.

Undoubtedly the chief attribute of an architect is the power to create buildings clothed with monumental dignity or gracious charm which shall uplift the beholder and help to quicken his artistic senses, which in these modern times have such sparse opportunities for development. Every one will concede this, and even the most soulless designer cherishes the hope that his elevations may meet with commendation. It is undoubtedly because of this universal acceptance of the essential characteristics of an architect that the leaders of the profession are, rightly, the great artists. They have, however, as leaders, a trust to discharge to the profession in all its aspects, and there is probably no calling which covers so wide a field, for an architect is expected to be equally ready to test a drain as to design an altar cloth, or to arrange for the installation of electrical plant as to create a monumental façade. It is not to be supposed that ability in all these diverse spheres can be equally developed in one individual; many of them are, if not antagonistic, at least somewhat incompatible with temperaments usually specially developed in some particular direction. Nevertheless, as we are constituted we do accept responsibilities covering these wide fields, and though a kind Providence seems to keep the feet of many to certain paths best suited to their capacities we must, in the nature of things, all involve ourselves in responsibilities for materials in the creation of structures, not mere products of the drawing board but, in all but a few cases, utilitarian realities for human occupation.

It may be said that technical matters should be left to pure technicians, the architect confining himself to questions of planning and design. Such a decision could not be lightly made, and could certainly not be fairly made for the profession by those whose work lies mainly in a purely artistic sphere, for however much we cherish art it would be found on analysis that by far the greater proportion of the livelihood of architects is derived from things in which artistic work has only a very small part. But assuming it were proposed to effect a wholesale sacrifice of the mundane aspects of our craft on the altar of our goddess and to leave work not calling for special artistic skill to others, would her influence be thereby increased? Would not rather a thousand opportunities be lost for giving to otherwise uncouth structures some touch of grace and proportion, and would not the world be soon filled with monstrosities so numerous as to overwhelm those who had spurned the technicalities of their calling? These, however, are little better than idle thoughts, for we *do* accept technical responsibilities of all kinds as part of our professional work, and at the last ditch it is the architect, and no one else, who is responsible for his building and everything the contractor puts into it. He

may safeguard himself by reserving means for personal redress against some party concerned, but the final liability is his.

We are apt to live too much in the past. Even a century ago building was a comparatively simple matter, and but few materials comprised the stock-in-trade of the constructor. Brick, stone, timber, slates, and tiles considered, little was left to worry the architect, and even these materials often had a local origin and their qualities were well known and obvious from surrounding instances of their use. Time, again, was less valuable; brick earths could be well seasoned; timber was cheap enough to admit of the removal of its less desirable exterior portions; the contractor was always a builder, and often an actual craftsman, who not only had a local reputation to maintain but who was sufficiently interested in his trade and had a sufficiency of time to enable him to do good work more or less spontaneously. It might well have been contended then that in those times such a paper as this should deserve no hearers, but we actually find instances of our great architects of that period taking an active interest in practical science, parallels to which it would be difficult to discover to-day. I have to thank Sir Arthur Shipley, in a most interesting historical note he has recently written, for a reminder of two examples. One, that of Leonardo da Vinci, not only a great artist but a man of science, who had a combination of studio and laboratory for his work; the other, Sir Christopher Wren, who in 1659 was one of the first pupils of Peter Sthael brought to Oxford by Sir Robert Boyle. Sthael is described as "a Lutheran, a great hater of women, and a very useful man," and his laboratory was one of the earliest in this country. Surely if any excuse were needed for pressing the claims of research we have it in this very early and classic example of Wren at the laboratory bench. Wren, as we know, may be regarded as one of the founders of the Royal Society, and was Professor of Astronomy at Oxford in 1661. It would appear, then, that science and art were at least not incompatible in this famous personality.

If Wren thought researches into the realm of science desirable in 1659, what of the modern architect of to-day? A mere list of the materials he handles would have left our great predecessor dumb with astonishment. Subtle powders such as cements, which may have any composition; clay products rapidly manufactured by machinery, aggregates of diverse family history, timber from unknown sources, metals varying enormously in properties with minute differences in composition, paints ready mixed and beyond hope of lay investigation, a host of patent materials, floorings, partitions, roof coverings, and builders' sundries daily flooding the market and with one voice claiming to be all things to all men. This does not end the tale, for many of these specific things before they come under the architect's eye, are woven into the engineering complications of a modern building in association with transportation, warming, lighting, power, and other services which form so large a part of most building contracts.

But the claims of science and research to be sustained must be reasonable and subservient to the main objects of architecture. It has been well said that we should know our limitations and not attempt to excel in fields outside our own sphere. The architect cannot be expected to be also a mathematician, physicist, chemist and geologist, and were he foolish enough to aspire to play a rôle so multifarious he would find himself accepting responsibilities out of all proportion to the duties of an individual professional man to his client. As an example, he could not possibly undertake to supervise in detail the chemical analyses of his materials nor physical tests upon them, nor could he put himself in the position of legal liability, touching the exact properties of his materials as laid down by laboratory standards. It is probably the fear of such demands as these which has in some measure delayed the development of research in materials as applied to building, for it must always be remembered that work in a particular sphere will only expand and prosper if it receives adequate appreciation and encouragement from those for whose benefit it is intended.

What, then, should be an architect's relation towards science? I hold that it should be this, that he should have a sufficient general knowledge of science, obtained during his early education and

developed in a manner showing its applications during his student career, to enable him to appreciate its value and understand, direct, and control, in a broad sense, the work of scientific experts whose assistance he may require to insure the best use of the best materials in his buildings. Without some knowledge and appreciation of natural science it is manifestly unreasonable to expect any belief in the utility of research on building materials, since we must look to science for these researches; hence I hope that these reflections on science generally may not be regarded as a digression from my subject. I am much tempted to abuse the privilege of addressing you and to embark upon educational themes relative to science in the service of architecture, but I resist in the hope that if research is agreed to be useful the necessity for knowledge to appreciate it will some day be the subject of a careful review by those responsible for directing architectural education.

But let us leave academic discussions and, before referring to specific instances of useful research, endeavour to briefly focus the problem.

After mining, the building industry is probably the largest in this country. The operatives directly employed cover very wide fields, while those engaged in the production and manufacture of materials used in building must be much more numerous. I have to thank the Ministry of Health, the Board of Trade and the editor of *The Builder* for help in obtaining the following statistics. Some 750,000 operatives are employed in the building trade, and, on the assumption that 80 per cent. are on full work at one time as an average, this represents a wage bill of about £3,000,000 a year, apart from the consideration of other contractors' costs. As regards materials, the annual production of building bricks is about three thousand millions, which, taken at the present price of London stocks, represents £15,000,000. One hundred million tiles are made annually, worth possibly £800,000. The production of cement is at present 2,250,000 tons, worth some £10,100,000. Some 200,000 to 240,000 tons of slates are mined annually, worth some £7,000,000. The value of imported timber, excluding pit props, sleepers and staves, has been given to me at no less than £66,750,000. In 1907, the date of the last figures available, the home consumption of paint materials exceeded £10,250,000, which, I am told, probably means £30,000,000 to-day. I have been unable to dissect constructional steel, but last year nine million tons of steel ingots and unmanufactured castings were produced in this country. The aggregate value of other materials—*e.g.*, marble, nearly £500,000, lead, zinc, brass, glass and other minor materials—must be considerable, but omitting these and steel we have an annual value of some £130,000,000, or a sum well over half our pre-War national revenue. These are figures for materials only; but when we reflect that a labourer's wages are almost four times and a skilled worker's wages nearly three times pre-War cost, and regard the resulting prohibitive price of building which is threatening the whole industry, the value of any investigations likely to improve the durability of our materials and add to our knowledge of their most appropriate employment seems obvious. It may be argued that this country has done very well in the past without organised research and that under the stress of competition those marketing building materials may well be left to their own devices and assumed to be producing the best possible goods in the most economical way. Were natural science recognised in this country as abroad this contention might be worth debating, but so few of our manufacturers have any real training in science that the possibilities of research are by no means widely appreciated, and only in the last few years has organised research applied to technical matters been considered. At the present time in Germany four new separate institutions for research are said to be projected, while in America three large trading concerns alone spend together about a quarter of a million annually and employ six to seven hundred people in such institutions. The Bureaux of Mines, Agriculture and Standards are national centres for research, while the investigations of such bodies as the Smithsonian and Carnegie Institutions have a world-wide reputation. Though technical research here is still in its early stages, no country has produced individual men of science superior to our own; and in speaking of research generally, a tribute should be paid to many who have carried out fundamental investigations and especially to the splendid work of the National Physical Laboratory, organised and for two decades

directed by Sir Richard Glazebrook. This Institution, as also the Geological Survey and Museum, have recently come under the control of the Industrial Research Department, responsible for encouraging and co-ordinating research in this country, and under it a Board of Building Research has just been formed; but funds for such work are generally very inadequate and are likely to remain so until public opinion alters the situation, and as far as building is concerned I submit that it is this Institute which should lead such opinion. Before the War America had some 20,000 university students, Germany half, and Britain but a quarter this number, which means that if we are to compete with other nations we must give these students, who provide most of our public men and potential scientists, a very definite interest in the problems which require solution. It may be argued that at the present time economy is so essential that funds are not available for research, but such an argument can only appeal to those unable to distinguish between economy and parsimony, and the necessity for economy is really a strong argument for research. Putting the annual cost of building materials in this country at as little as £100,000,000, an improvement in materials averaging only 5 per cent. would leave a very handsome margin of profit—apart from additional peace of mind to architects—after deducting a few hundred thousands a year for interest on capital and current expenses which the requisite investigations would involve.

A research problem generally has two ends, and these often belong to different professional or commercial spheres. Hence, in many cases much advantage would result by collaboration. As an example, many defects in materials arise from injurious atmospheric influences, and an attack should be made simultaneously on improvement of materials to resist such influences and on the reduction of the impurities in the air which are deleterious. Obviously co-operation between these two sets of workers would be valuable, as the possible improvements on either side must necessarily be closely related.

The utility of research is well exemplified by the extraordinary improvement in certain materials, the result of rigid demands by engineers. Steel, which can now be obtained of uniformly high quality suitable for a great variety of purposes by making very trifling but all important changes in composition, is an obvious instance. Cement, which we can now so comfortably specify as having to conform to the British Standard Specification, is another striking example. The high and certain qualities obtainable in these materials is the result of patient research stimulated by demand. If we could purchase our materials on the basis of the essential qualities we wish them to possess, stimulus to improvement would be vastly increased. Suppose, for example, that we bought cement by strength and paint by durability, instead of by the more primitive standard of weight, in which we are not the least interested, and which attribute is indeed an incumbrance, how much material of poor quality which masquerades as "best" would disappear from the market, and how the best would improve merely for commercial gain. Such form of purchase may not at present be practicable in many cases, but we should keep this point of view in front of us.

It is to be feared that our supineness on certain small matters which could easily be rectified by more rigid demands often leads to troubles quite disproportionate to their initial causes. May I cite one instance? We are constantly troubled with cases of dry-rot in timber, and in those which have come under my notice quite half are due to defective rainwater pipes. Now, the ordinary rainwater pipe is so cast that it is usually thinner at the back than in front, hence its vulnerable unpainted side readily perishes and the pipe leaks against the wall, the defect being often undiscovered until some dormant spores wakened into life by moisture begin their ravages upon the ends of joists or other internal timber. Were these pipes more rigidly specified the immediate result would no doubt be trouble, delay, and increased cost, but this might be got over by giving notice in advance of an R.I.B.A. standard to be required, and very soon defective goods would be ruled out of reputable work with great national saving.

It is quite impossible on the present occasion to attempt any comprehensive outline of suggestions for specific researches likely to be valuable to architects, the building trade, and building

owners; but, lest I be accused of advancing mere vague generalisations, I feel I must mention a few, well knowing that there are many in this room much more competent to formulate such a list than myself. There is a great deal of work to be done on building limes, which are capable of improvement and are in every way suitable for much work in place of Portland cement with considerable economy. I have recently obtained from Washington a small Government publication showing how vastly in advance of ourselves the Americans are in the use of these materials, and how much an organised research in this industry, which seems to have had little attention from our scientists, is wanted.

LIME.

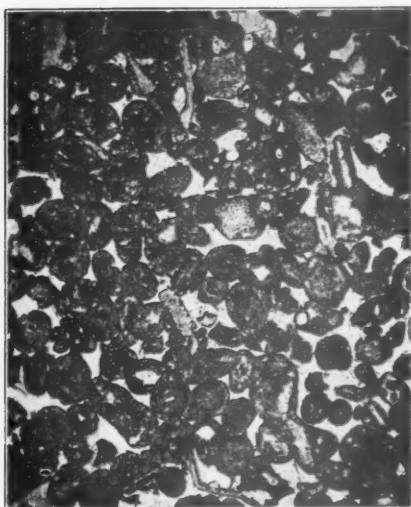
Before the days of Portland cement all our buildings were erected in lime mortar. The area of the top of the 18-inch brick cone to the dome of St. Paul's is about 150 square feet, and this sustains the cupola, weighing 700 tons; hence the lime mortar joints must be carrying more than 4 tons per square foot, a weight which we should hesitate to place on many walls of modern brickwork. Cement is scientifically manufactured, and made to conform to definite and rigid specifications. The lime industry, on the other hand, is much as it was a hundred years ago. Lime is an inconvenient material to store and handle, and probably with improvement and increased demand could be much cheaper; but in America, where the lime industry has made enormous developments in the last twenty years, the burnt stone is hydrated and marketed as a dry hydrated screened powder, which keeps fairly well, does not expand or fire, and carries as much sand in mortar as the unhydrated lump material. At the present time, on actual material only, about £1 a rod for equal condition of transport can be saved by the use of lime in place of cement in brickwork. More important, however, is (or ought to be) the saving in wages in building in lime, as a man can work with it much more rapidly. A bricklayer of 50 years' experience recently questioned put the saving in labour at one-third.

The methods of improving our weaker limes are becoming forgotten. In 1856 a patent was taken out for Scott's Cement, formed by the mere addition of a little gypsum to stone lime. Tests are available showing that the strength of mortar can be thereby more than doubled. Street used such mortar in 1878 in building the Law Courts, but I have not found anyone conversant with this material at the present day.

STONE.

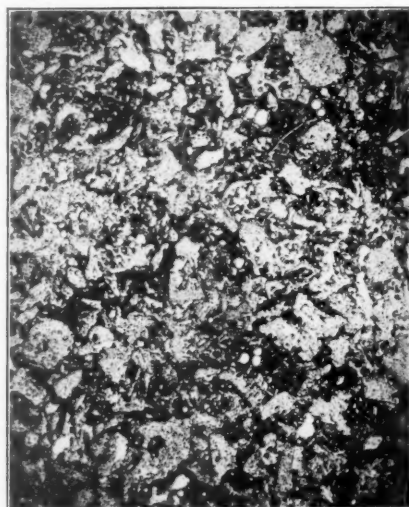
Public interest has been lately much aroused on the question of the decay of stone in our national buildings. Our Science Committee have had this subject in hand, and, thanks to the generous co-operation of H.M. Geological Survey, the results of a ten years' exposure test on a number of common building stones are now under consideration.

The disintegrating influences which affect stone in buildings give rise to great expense and trouble, and the remedies employed are by no means always satisfactory. Most freestones take a skin hardness after quarrying, due possibly to the deposition of solid bodies near the surface on the evaporation of the "quarry sap." This skin once removed never seems capable of replacement, and there is always a danger, in applying solutions or chemicals which result in precipitation, of obtaining a skin which by further disintegration becomes detached from the stone, leaving it worse than before. I fear we shall be told that much of our architectural ornament in stone involves the use of material in a manner which can only lead to decay through lodgement of dirt and moisture even in a comparatively innocuous atmosphere. Probably the physical characters of stone are more important than chemical differences in composition. Bath and Portland stone are very similar chemically, and are both oolitic, and it may be left to the mineralogist and crystallographer to explain the great difference in their weathering properties. Again, compactness is no criterion of durability; for example, Ketton stone, with its large, rounded grains, weathers in town atmospheres better than some stones more dense in character. The durability of a stone often depends much more on the character of a small percentage of cementing material than on that of its main ingredients. Scientists have yet



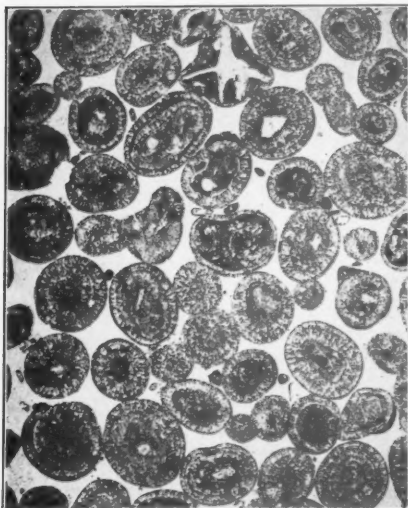
LIMESTONE (PORTLAND WAYCROFT).

Opaque colitic grains of medium size, mostly without well-marked structure. Most of the clear patches are masses of crystalline calcite.



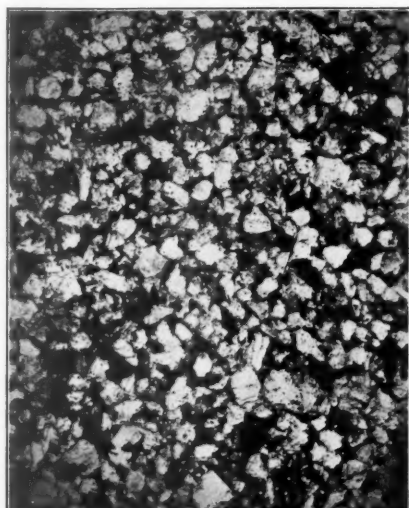
LIMESTONE (BEER).

Mainly composed of corroded fragments of echinoderms in a matrix of crypto-crystalline calcite. The clear round forms are foraminifera.



LIMESTONE (KETTON).

A very perfect example of colitic structure, showing both simple and compound grains, with both radial and concentric structure. Matrix is clear crystalline calcite, with crystals developed on a large scale, so that many of the individual grains are enveloped in a single crystal of the matrix.



SANDSTONE (CRAIGLEITH).

Sandstone with a considerable amount of felspathic material.

Slides shown reproduced (to a reduced scale) from the Album of ENLARGED PHOTOGRAPHS OF BUILDING STONES, arranged by the Science Committee R.I.B.A. (March 1911). The magnification is about 20 diameters.

told us little about the real meaning of adhesion and cohesion, and we seem a long way from any standards by which to measure these important properties.

BRICKS AND TILES.

We are all conversant with the disastrous defects which often occur only after some years in roofing tiles. This subject again our Science Committee has been endeavouring to tackle, and has collected a number of defective samples, thanks largely to the assistance of Mr. Greville Montgomery. A careful report is wanted on the conditions of manufacture and an investigation into the subject of shelling, lamination, and the effect of slope angles, and climatic conditions. Why should the old tiles last 150 years, while many modern ones are hardly able to stand a single decade?

The wonderful condition of certain old tiles after a century of wind and weather is ascribed by some to the mellowing of the clay before use. This mellowing can only mean disintegration and chemical changes, including the removal by solution of undesirable ingredients, and there seems no reason why the chemist should not seriously take up this subject with a view to removing the loss and embarrassments resulting from defects in composition. As regards pressed tiles it must be remembered that almost any substance tends to laminate under pressure: even such a homogeneous material as wax will show this effect. It would be interesting to discover whether any relation exists between durability and plasticity, a property much influenced by hydrated oxide of iron and carbonaceous matter as well as by the amount of true clay substance—kaolin. Bricks used in such vast quantities require more attention as regards impurities such as appreciable fragments of lime and objectionable soluble sulphates. The danger of lime in bricks and tiles, of course, arises from the great expansion resulting in the presence of moisture. When in minute fragments the porosity of the material is usually sufficient to admit of this expansion, but when lime is present in pieces of appreciable size cracking or bursting must result. Lime cartridges, indeed, were used before the days of gunpowder for blasting. Fortunately lime is very easily detected.

The "salting" of bricks again, due largely to sulphate of soda, often has disastrous effects on decorative work, and this efflorescent material may be formed by faulty firing and bad coal even if absent in the original clay.

TIMBER.

Timber in its converted condition is a material upon which many researches are urgently needed. Most of our other materials are of mineral origin and their decay is due to oxidation or other chemical reactions which limit the field to the work of the chemist, physicist and mineralogist. Here, however, we have an organic edible substance open to the ravages of insects and fungoid growths. We are all conversant with the defects produced by boring beetles or worm, though the work of these industrious insects is often neglected. Many of our fine old roofs and much hidden structural timber falls a prey to these creatures, and we are all much indebted to the researches of Sir Frank Baines in the extermination of beetle at Westminster Hall and for his rendering this experience generally available. Dr. Gahan, of the Natural History Museum, has recently issued a valuable pamphlet on the various kinds of beetle and their habits, but there is much yet to learn. More dire and urgent is the terrible scourge of dry-rot caused by the fungus *Merulius*, which almost amounts to a national plague, much accentuated since the war as the result of the use of sappy and unseasoned timber and the inevitable neglect of property which has often allowed deterioration to extend so far that insufficient protection from weather has resulted. What the annual cost of this pest is it would be unwise to hazard, but as a mere unit among our many brethren I have seen probably a dozen cases involving repairs amounting to many thousands of pounds in the last twelve months. Yet we have not a single recent comprehensive volume on the subject in this country and but few workers, and these mostly engaged also on other duties. The mycologist has little regard for the practical side of this problem, while the architect considers it too botanical for his sphere of action, and as far as I am aware our students are taught

little or nothing about it. Meanwhile the country suffers while no effort is made to stamp out infection at its source. Much might be done to check the evil by insisting upon more sanitary conditions at the docks and in our timber yards, where infected wood is often treated with no more care than brick rubbish and, indeed, is sometimes used as a convenient substratum in which to place sound timber. Our Science Committee is making what will, I hope, prove a valuable investigation into the storage conditions of timber, and after the submission of its report to the Council it is to be hoped that, if this course seem justified, this Institute will press for legislation to improve and control conditions of timber storage. Meanwhile we want an organised body of whole-time workers prosecuting researches into the entire subject of diseases in converted timber, and probably few national investments would pay better. At the instance of the Science Committee the Council brought this subject to the notice of the

Industrial Research Department a very short time after the formation of this body. This should be regarded as a national problem and should not be relegated to trade associations interested in producing some protected specific or even to State-aided private workers. In dealing with a material the total annual value of which is over 80 millions, it would not seem unreasonable to ask for a quarter of a million to provide and endow a suitable institute. We want first a ready means for detecting spores of *Merulius* and *Polyporus*, an investigation into distribution of the disease, which is known to be specially prevalent in certain districts, and then the consideration of regulations which shall bring this infection under control. Is there any real reason why this disease should not be virtually



DETAIL OF DRY ROT *MERULIUS* IN FRUITING STAGE.
(The fungus has penetrated a brick wall 3 ft. 6 in. thick.)

stamped out, and could not this be effected by the Board of Agriculture and the Board of Trade when the mycologists have told us more? The other end of the disease problem is the production of timber so treated and seasoned that it will better resist decay.

There are, of course, a great many other aspects of timber which merit investigation. Many woods grown in our Empire overseas are little known and merit exploitation. The Imperial Institute Advisory Committee on Timber, under the chairmanship of one of our Fellows, is doing excellent work in this direction, and I have to thank Dr. Chandler of this Committee for preparing some specimens of Nigerian and British Columbian timbers which are shown here this evening. At present it would appear that freight costs are against many of these timbers, but it would seem desirable to give them some form of preferential treatment, more especially as the Russian market appears likely to be uncertain for a considerable period.

METALS.

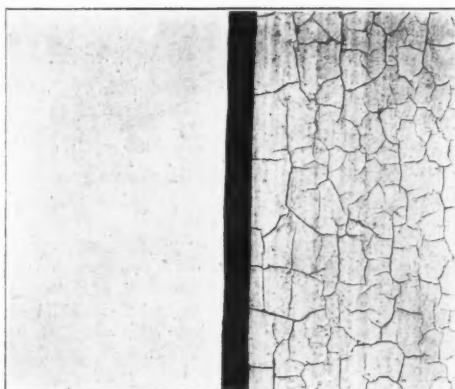
In the decay of metals atmospheric impurities play an important part, but moisture and carbonic acid, which must be regarded as normal constituents, are responsible for decay apart from aggravating additions such as sulphuric acid found in most town airs. Attention has recently been directed to the preventive or inhibiting action of certain substances as, for example, lime protecting iron in concrete. Again, we have now certain steels which resist corrosion owing to the presence of small quantities of vanadium. Most commercial metals are really alloys and a great deal has yet to be learnt on the composition of alloys relative to resistance to corrosion. The discovery of a metal strong enough for structural work and

cheap enough for use which will resist atmospheric corrosion and therefore will not require the services of the painter does not seem an impossibility, and such a discovery would be worth many years of well-paid research work. Even if an alloy research failed some skin treatment at the time of manufacture might prove effective. I have here an ingot of copper clothed permanently with that beautiful red oxide temporarily produced on clean copper by a London fog. This has had quite a chequered career in my possession for 30 years, but its surface remains clean as it came from the mould. The decay of zinc is really a very serious matter for owners of small town property and probably depends in a great measure on impurities in the metal. There is no special difficulty in preparing pure zinc, nor should it, I think, be prohibitive in cost. It would be a comparatively simple matter to produce cost and durability statistics for various qualities of this metal.

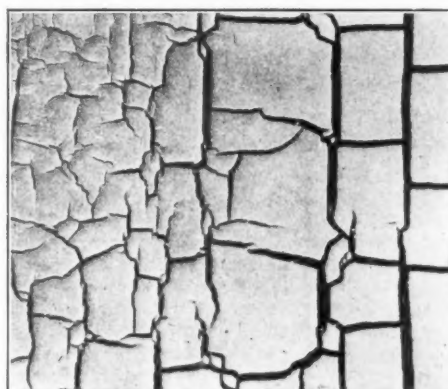
We are looking forward to information in the discussion about the activities of the Industrial Research Department's Building Board, but I should like to mention one investigation initiated by the late Research Committee of this Institute and brought to fruition by the great assistance of the Institute of Metals, and the financial support of trade associations and the department just referred to. This is a research, at a cost of some £800 a year, on atmospheric corrosion of non-ferrous metals such as brass and gunmetal fittings so largely used in buildings. This work has only been going on for a few months, but results as obtained will be made generally available.

PAINTS.

Paints and varnishes, perhaps the most difficult of materials to assess, need more experimental work. For example, experiments made some years ago in America showed that in two similar paints the size of the solid particles were respectively 125 and 2,500 to the linear inch, and that the latter had twice the durability of the former. Oxide of iron paint in oil varies in price more than 50 per cent. according to quality, but very slender means exist for ensuring that we get the best when we demand it.



The clear portion of slide is good white lead paint : the crazed has too little binding oil.



Rosin, linseed and wood oil; cracks produced by too much rosin.

The solid body matter in a paint possibly bears some resemblance to the aggregate in a concrete, the oil acting as a vehicle and binding material, and if we want our paints to resist weather it does not seem unreasonable to use our experience of concrete as an analogy. It has been proved that aggregates to resist moisture must be composed of particles of varied size, and it seems not unlikely that this would prove true of paint bases. Moreover, varied size in aggregate particles makes for greater strength. A thin elastic film of dried oil may not be comparable with crystallised lime, but there are some who hold that even the setting of cement is entirely due to colloidal or glue-like bodies.

The different materials used in the paint trade, including the vast number of pigments, do not number much less than a thousand. Among the 150 pigments in common use about 17 per cent. are liable to fade, and this is a subject worthy of investigation. The nature of the gums and resins, a most difficult subject, is yet imperfectly understood, and varnishes which are made from these resins are open to much adulteration. The recent use of substances of vegetable origin dissolved in organic liquids—for example, the so-called cellulose acetate—suggests that our organic chemists might help in finding substitutes for some of the very costly varnishes now used in first-class work.

Though painting may be a very small matter in an initial building contract, its periodical repetition makes the material really important. It has been recently estimated that the black smoke of Manchester costs this city annually three-quarters of a million, and much of this cost must be due to paint renewals.

GLASS.

Our Research Committee started an investigation on the improvement of pavement lights, and, through the kindness of an optical expert, and the makers, samples of a new glass have been exposed in a London pavement for three years. The results of this experiment do not promise to be satisfactory, but it should really now be possible to produce a transparent medium able to resist abrasion, which would result in great improvement to much basement property.

These are but a few of the problems which deserve attention, but many others suggest themselves, as, for example, proprietary plastic floor and wall coverings, which should at least be guaranteed not to contain certain injurious ingredients. Again, such subjects as the acoustics of buildings, to which study a special institute is devoted in America and, I believe, also in Germany, though strictly outside the scope of this paper, demand much elucidation.

In conclusion I will now show a few slides got together by the kindness of friends interested, and one or two simple lantern experiments.* These are not intended to illustrate researches as much as to show how the minute probings of science can help us in our diverse and often difficult duties.

I cannot hope that my very inadequate plea for research has to-night made many converts, but would rather assume that the matter does not admit of controversy. If this is agreed, then I regard it as the duty of this Institute, with the most necessary and valuable support of the building trade, to take steps to get into closer touch with our great men of science and with departmental and other bodies which have funds at their disposal for this work.

* The lantern illustrations included the demonstration tanks, showing the effects of immersion in a solution of sulphuric acid of pieces of sandstone and limestone, and colour tests to distinguish pieces of silica and lime from brick. Demonstrations by the same medium showing: (1) the formation, in an orderly arrangement, of crystals of metallic lead from solution by electrolysis, and (2) the slow and rapid solution of zinc in acid to illustrate the life of pure and impure zinc in zinc flats in towns. Slides of greatly magnified sections of tiles prepared by Mr. H. W. Burrows [A.], illustrated the lasting nature of the old hand-made tiles compared with those of modern machine manufacture. A red roofing tile believed to be Roman, taken from a fifteenth-

century building in Suffolk, is still in good condition; others 70, 150, 200 years old are in excellent condition, while machine-made tiles, specimens of which were exhibited, had weathered so badly that the roofs from which they were taken had to be renewed after a decade or so. There were also exhibited slides of some of the building stones which the Geological Survey, in conjunction with the R.I.B.A. Science Committee, have had exposed in London for ten years, their condition both at the beginning and end of this period being shown. Slides showing specimens of iron and wood covered by paint and varnish prepared from panels lent by Messrs. Mander Bros. were also exhibited.

DISCUSSION ON THE FOREGOING PAPER.

The President, Mr. JOHN W. SIMPSON, in the Chair.

Sir RICHARD GLAZEBROOK, K.C.B., D.Sc., F.R.S., late Director of the National Physical Laboratory: I rise with great pleasure to propose a vote of thanks to Mr. Munby. He has just said that he has laid before us a very inadequate plea for the use or utility of science as applied to building construction and building work. While one agreed with most of his Paper, I think everyone in this room will dissent from those last words. (Hear, hear.) The plea which he has put forward for further research and investigation in connection with building materials is one that it is impossible to resist; at the same time it is one which it is difficult to add to. He has stated the case with extreme clearness and fulness; he has called our attention to the vast importance of the industry, to the large sums of money with which it is concerned; and he has indicated, in various ways, the manner in which science has hitherto helped, to some extent, in connection with this industry, and he has pointed out directions in which science may help in the future. The plea seemed to me to be far from inadequate; it seemed to be very strong and forcible, and I trust that, if it was necessary to make converts in this room, he has converted the whole audience to his way of thinking, and that this meeting may prove to be the commencement of a period in which scientific men do aid the building industry to a larger extent than has, perhaps, been the case in the past. Mr. Munby has been good enough to refer to such work as I was able to do during my twenty years' tenure of the office of Director of the National Physical Laboratory. During that time it was my business to aid, in any way that I could, the application of science and scientific knowledge to industries of all kinds, in which the building industry was not by any means neglected, though it was not one with which we were brought most intimately into contact. I do not know that I can enforce what Mr. Munby told you better than by referring, very briefly, to a few cases in which investigations bearing on matters of interest to the building industry did take place, and led, I hope, to some results of more or less importance. And the matter is of the more importance at present, when so much of the work of the architect is necessarily that of the engineer and constructor. The methods that have to be adopted in the construction of our buildings at present differ, I think, entirely from those which could be used by our forefathers. The fact that you utilise, to the extent you do, steel, and materials of that kind, and—perhaps most difficult of all—reinforced concrete in its various forms; the fact that the buildings are so much greater than most of those of old days, these facts have all produced special difficulties and have raised questions that involved very careful and delicate investigation. So in the early stages of the Laboratory one of the matters brought

most prominently before us was the necessity for being able to test building materials on quite a large scale; to test large beams, ferro-concrete beams in some cases, or pillars of the actual sizes that were used in engineering practice. As a matter of fact, for various reasons, in early days that proved impossible. There were difficulties of various kinds, and the expense of it and the cost of the machinery needed was outside anything that could be then afforded. But some few years ago the question became more urgent, and Sir John Cowan, representative of Redpath, Brown & Co., pointed out the extreme necessity for further research in ferro-concrete work; and by his generosity a machine was planned which was to carry out tests of ferro-concrete beams and other work of that kind. As a matter of fact, the war came before the machine was erected, and the whole matter has been delayed in consequence; and I am not sure that it is in a complete state for full-scale work at the present moment. But it will be so before very long, and the difficult work required on ferro-concrete will be able to be carried on at the Laboratory, thanks to the generosity and the far-sightedness of Sir John Cowan and his fellow-directors. And that leads us to consider one or two other problems connected with ferro-concrete. I have in my hand a paper, which was sent to me recently from America, dealing with the effects of stray-current electrolysis in various materials, building materials among them, and especially concrete work. It is by one of the Staff of the Bureau of Standards of Washington. The paper contains results of experiments such as Mr. Munby has referred to. The danger to building materials from electricity is not, perhaps, a very great one, the actual voltages which occur are not such as to often do much damage. But they may do harm, and I have here some figures showing the kind of action which takes place in certain cases, and the damage which is actually done. The first figure refers to a block of concrete with iron in it; the current has been passing through the concrete and iron, and the result has been to split the block. What happens there is that, as the current passes into the concrete, chemical action takes place, and the concrete swells, and if the action is great enough, it may be enough to burst it. There are other matters connected with ferro-concrete which have been investigated in America, and which need further research here, I think; though, as I have said, it would appear that the strength of the leakage currents is not such as to be really a very serious source of danger to us here in England.

Another question which we have investigated at some length deals with the thermal properties of materials used in buildings; the rate at which heat passes through these various materials, and the best method of maintaining the temperature in the house

or other building. Some time ago we made, at the request of some contractors in the first instance, I think, some tests of the various roofing materials which have come in: materials which are made of some kind of cement or plaster, with embedded fibrous material worked into the form of tiles. It was supposed they would be particularly good for maintaining the temperature of a room, that is, that they would be bad transmitters of heat. But, very much to our surprise, when the experiment was tried it was found that ordinary galvanised iron was very much better—quite 20 per cent. better—than any of these materials, so far as allowing the transmission of heat from the inside to the outside of the building was concerned. The fact is that, although the passage of the heat through the iron was more easy than the passage of heat through the fibrous material, the rate at which the heat escaped from the outer surface of the iron was so much less than that at which it escaped from the outer surface of these tiles that the iron had a 20 per cent. advantage. A number of experiments have been carried on recently at the request of one of the Boards of the Research Department, the Food Investigation Board, on questions relating to the thermal conductivity of materials which are used in cold storage work. A very large number of materials are used in cold storage work, and an elaborate investigation has been made as to the rate at which heat will pass through these materials. Dr. Griffiths, who has been doing the work, has sent me a few figures. As a matter of fact it appears that there is not a very marked difference between the various materials. It was a case of measuring the rate at which heat passed through—in British thermal units—per hour per square foot of surface one inch thick. Cork, slagwool, and charcoal allow the passage of '33, '31, '29 units, and so on. Diatomaceous brick earth, which is much used, allows the passage of '5 to '6 unit, cement 1 unit, and bitumen 6 units, concrete block 8 units. So that while only one-third of a thermal unit will pass through one inch of cork slab, 8 of them will, in the same time, pass through a slab of the same thickness of concrete. Another piece of research which is being started is a similar kind of experimental work on materials which are used in building—bricks and stone, and concrete slabs, also mixtures of all kinds. That apparatus has just been erected, and the experimental work will go on shortly. Turning to another matter, we were consulted not long ago, by the Office of Works in the first instance, on the problem of devising a roof for lighting a big picture gallery. The walls of the gallery were north and south, and the wish was to give equal illumination to the south walls as to the north ones. A roof was designed, and a model building set up; and though that has succeeded in giving fairly uniform illumination on both walls, it is in other respects not quite satisfactory. The result is that there is being put up now a room, I think, 60 by 30, or something like that, and 17 feet high, so arranged that temporary roofs of various kinds can be put on this building and

the effect investigated of allowing the light to enter from the roof in various manners. In that way it is hoped to solve the problem and get the required illumination for the pictures on all the walls of the gallery. I have ventured to mention a few researches in matters relating to building construction. Although I have no position at present which would enable me to speak with any authority as to what the Laboratory can do, I am quite sure that my successor, who is at least as interested in these matters as I was myself, and those who are now controlling the Laboratory will be prepared to give any assistance which may be possible to this Institute in carrying further the very excellent and admirable suggestions which have fallen from the author of the Paper this evening. I beg to propose that he receive a very cordial vote of thanks.

Sir E. RAY LANKESTER, K.C.B., F.R.S.: It is a very great pleasure to me to come this evening at your invitation. And I must say I came as one having, as we all have, an interest in the roof and walls which cover us, and to hear what Mr. Munby would have to say on the subject. I confess I thought he was going to speak chiefly on building material in the sense of stone, concrete and timber, and I thought of my earliest recollections of the present Houses of Parliament. The magnesian limestone was acted upon by the London atmosphere and it began to decay when I was a boy, and my father, together with other scientific men, was called upon to report on the best means of preventing this decay from spreading. I remember it was proposed to apply waterglass—i.e., silica—to the surface of the stone, and eventually, I think, a resinous compound which, I believe, still exists, called, I think, Zerehmy, was applied to the surface. Later in life I came upon the University of Oxford, where there was a terrible decay of building material; the whole place was being continually repaired; it was in a state of foliaceous lamination, always falling to pieces, bits were falling down in the college quads as one walked along. I think that was due to some mistake on the part of the architects of the time in the use of a particular stone. It used to be said that they had set the wrong end up! (Laughter.) I think they had a very bad local stone; and they still do it. That is the kind of matter I thought I was going to hear about to-night. Then I found that Mr. Munby suddenly lifted the veil and showed that the architects' concern is with the whole mundane sphere of existence; everything which there is comes under their use and scope; they have to know all about it. I previously regarded the great architect as, perhaps, the greatest thing that any professional man could be, and I have often thought of the two great architects, Leonardo da Vinci and Sir Christopher Wren, two samples of humanity who really did take in an enormous view of Nature and of real things which they were able to bring to bear upon their magnificent profession. Mr. Munby mentioned some of the accomplishments of Sir Christopher Wren, but one thing which has always interested me, and which seems to be largely forgotten, is that, when he was a

Fellow of All Souls' College at Oxford, he made the beautiful drawings of the human brain which illustrate the great book on the anatomy of the brain by Willis. In this book the various cranial nerves are designated for the first time by numbers. So this extends the sphere of activity of that great man beyond even building materials to the thinking material which guides the erection of the great buildings. I am extremely interested in all that I have heard, both from Mr. Munby and from my old friend, Sir Richard Glazebrook. The area of investigation which is asked for is simply enormous; it is hardly possible for anybody representing a particular profession to undertake that investigation. But the attitude, it seems to me, of any practical man in a profession is to propound the problems: to say "I want to know this," "I want to know that." And these questions can only be answered effectively at leisure; they cannot be answered rapidly and immediately by the different bodies of scientific workers who have to do with the subjects on which the questions are asked. (Hear, hear.) For instance, no serious knowledge of stone can be gained by a rapid survey of the microscopical structure or the chemical composition or the rate of attrition of stone; it is a tremendous question, involving very minute investigation of a special kind, and it can only be carried out by an accomplished chemist. And so also in regard to other matters. The research cannot be set up as an architectural research, though the questions may be propounded by the architect, and the answers may be given by institutions like that over which Dr. Glazebrook presided so long and so well. For instance, with regard to the question of "dry-rot," which is a biological problem and comes near to the scope of the problems with which I have had to deal, that cannot be rapidly dealt with. The study of fungus growth and its relation to particular beds in which it can grow, and the particular materials it attacks, is a lengthy and difficult matter, and, so far as I know, there is more than one kind of fungus concerned in what is called "dry-rot." But, if further information is required on the subject, you must propound your difficulties and questions, and state what occurs in buildings, and mycologists and persons acquainted with the nature and growth of fungi and moulds can be called upon to investigate those questions. But it must be done by men having special skill and knowledge. And so again with regard to boring larvæ, beetles, etc., it is an elaborate matter to know how to check them, and must be made the subject of very careful experiment. It seems to me that all this Institute can hope to do is to pose the questions, to point out what it is they want to know, to express a desire that this and that investigation shall be carried out. But they cannot organise that investigation themselves. I have very great pleasure in seconding this vote of thanks to Mr. Munby, whose address was certainly almost a revelation to me as to the enormous area with which the architect is concerned, and the tremendous basis of knowledge he ought to have, and, no doubt, very often has. (Laughter.)

Mr. H. O. WELLER, Director of Research, Building (Materials and Construction) Research Board: The Building Research Board does not pretend to omniscience: we want our Board to be a clearing-house; we do not set out to tackle any problem unassisted. For instance, faced with a problem in stone preservation, we started by getting hold of two experts on stone, Dr. Desch and Mr. Howe, and we could not have two better people. The Board was formed last summer. We were retarded in getting an experimental station of our own, but it is now being built at East Acton. It will have a chemical laboratory, an engineering laboratory, and a builder's yard equipped with instruments of precision. The Board is formed under the Research Department, which is constituted under a Committee of the Privy Council. Mr. Balfour is the Minister, and I do not think it is wrong to say it is due to Mr. Balfour that the Building Research Board was instituted. There were objections before, but Mr. Balfour cleared them away. (Applause.) The terms of reference are "Materials and Construction." Mr. Munby's Paper this evening is on materials, so I will deal with that only now. Our policy is, after a survey, to attack fundamental problems only; it is quite impossible to attack all the problems which are before architects. After a consultation with the Portland Cement Research Association, we are tackling the setting and hardening of cements. It was a problem suggested by the Faraday Society a year or two ago, but the work on it was held up by the war. We have one chemist starting work under one of the well-known experts. And we have a small problem concerning the colloidal properties of clay. In Paint Research we have at present only one problem, the search for new bases to replace lead. Then there is the standardisation of materials, or the issue of standard specifications. Mr. Munby was saying how engineers have been helped by specifications in steel, and architects by specifications in Portland cement. We think there should be standard specifications for sand-lime bricks and Iron Portland Cement. We are working this through the British Engineers' Standards Association. Any material they will not deal with we might work at in conjunction with the R.I.B.A. There are things which do not appeal to engineers which might appeal to architects, and for this I suggest, tentatively, we might have a Royal Institute of British Architects' Specification series. (Applause.) We are working on a few new materials which have been discovered by other Research Boards. There is a new flooring material, a new distemper base. We are also watching a very interesting new cement. Another research we have started is stone preservation. After some little survey of this we have decided to base our work on the use of silico-fluorides. They have been used a great deal on the Continent, in France especially, but they have not been used in England, except that there is one salt sold like a patent medicine. Sir Richard Glazebrook mentioned the transmission of heat through materials, and the experiment we have in the

National Physical Laboratory. We are continuing the use of a very ingenious piece of apparatus which Dr. Griffiths was using for the Food Investigation Board. With that he has investigated all kinds of materials used in refrigerators, and we hope to carry on the work—that is, Dr. Griffiths will for us—with building materials. Our methods of working are direct and indirect; direct by work at our own central station, and indirect by subsidy of approved workers who will attack problems of interest to themselves and to us. The Department generally is always open to applications; they need not necessarily be made through the Building Research Board, they can be made direct to the Secretary of the Department. Another branch of our work in which I should like the help of the Institute is in the study of failures. One learns much more from failures than from successes—(Hear, hear.)—for if a structure succeeds you do not know much about it; it may be ten times too strong, or you may have got it just right by a fluke. But a failure enables you to find out something. Any information about failures will be of great interest to us, therefore. We intend to make results available by publication in the form of special reports, or by allowing investigators to read Papers before societies. That is the general policy of the Department. In the third paragraph of Mr. Munby's Paper he says: "It may be that technical matters should be left to pure technicians, the architect confining himself to planning and design." The root of the word "architect" suggests that he should be, above all things, a technician. There was mention of the amount of money they get for these things in Germany—a quarter of a million sterling, and so on. If we had all that money we might be able to do many things. However, we have a certain amount of money, and I hope it will be used efficiently. With regard to timber, there is a Timber Research Committee in the Department. The work is under a botanist, Professor Groom. We are keeping to our own problems at the moment. I, too, think Mr. Munby ought to have made plenty of converts this evening, if architects do need converting. I would like to read a quotation out of a book by one of the greatest architects—Viollet-le-Duc. Speaking of builders of the twelfth century he says: "We are not surprised to find among these builders a profound knowledge of the materials suitable for building and of the resources furnished by their use." And again he says: "Excellent materials are detestable if used in disregard of their proper place and function." (Hear, hear.)

Mr. J. ALLEN HOWE, Assistant Director to the Geological Survey: I have viewed with the greatest interest the field which has been so eloquently opened out to us by Mr. Munby. Not only has he explained the many opportunities that are before us for research, but he has given us what I may almost describe as a picture show in addition, which I have enjoyed very much. Mr. Weller has told you about the multiplicity of the work he is undertaking; I must myself stick to one material, the only one I know anything about,

that is stone. I may be able to relieve Mr. Munby in one respect, because I have come to the conclusion, in regard to research into natural stone as a raw material, that not enough use has been made of the results which have been arrived at in regard to it; that is to say, architects and engineers do not use the results of the tests, and the enormous amount of labour which has been expended in finding out the qualities of stone, its chemical, mechanical and physical properties. And it is easy to explain why the tests are not used. Stone differs from most of the other materials which you use in building—except timber—in being a natural product, one which you do not have any finger in making yourselves. You cannot decide beforehand what a stone is going to be like: you have to take it as it comes. It is that individuality in every piece of stone which gives the charm to its use in building. And you must take the good with the bad, because when the stone is being weathered and moulded by time, you get a good patch here, and a bad patch there, it makes all the difference to the final aspect, whether in ornamental work or in a plain wall. Stone has a character of its own. That is why it is of little use going on with experimental work on stone from that point of view. I have given much time and trouble to the study of this problem, and that is the conclusion to which I have arrived. I do not say further work should not be done on stone: we do need more work on it. For instance, in regard to our own British stones, we have not yet a complete directory of British stones, only fragmentary information. We have no work which we can turn up and say "This is all we know about granite, or about sandstone, or about limestone." I think we are now in a position at the Geological Survey to remedy this; the Director has in contemplation a report upon the different stones, taking a group at a time. And we shall look to this Institute for advice as to what tests, if any, you would like applied to these stones, so as to have proper data published with regard to them. I have my own ideas clearly on the subject, but I am open to instruction, and I think I can say, for the Geological Survey, we are prepared to undertake, directly or indirectly, any tests which you feel would be useful. We hope to take this work in hand soon. I think I may say that the research on stones may be grouped under three heads. We have, in the first place, research on natural stone, its mechanical, physical and chemical properties. Then there is the question of what to do with the stone in the old buildings where the stone itself has gone, as has seriously happened at Oxford, for example, where much poor stone was used. But even good stones fail here and there, and they do so in particular parts of a building. And may I make this suggestion—and I do it with humility in the presence of architects—why not, in the parts of the building where the stone is known to be subjected to particularly trying attack by moisture, and so on, and it is generally in a situation a little out of sight, why not place instead of stone some other material in those positions? It might be a subject for research as to

what materials you would substitute. It seems a little stupid, because stone is used in the lower part of a building, that you must necessarily put stone in the higher and more exposed parts, positions where you know beforehand it will certainly be attacked. There can only be a sentimental reason for carrying stone right to the top. It would be an important subject for research to find what material can keep its appearance and be a good substitute for stone. My friend has been mentioning silico-fluorides, and I have come to the conclusion that is the only treatment we know at present which is any good, yet I am sceptical about the application of it to the old building stone. I have never yet seen old treated stone which has lasted even a few years very satisfactorily. After a year or two, another application must be made of the same substance, and if you have to go on doing that you might as well have cement or other substance, because you are altering the look and character of the stone. It is a difficult problem, but it is one well worthy of being tackled, and I feel sure every effort is being made to get at the bottom of it. There is a third means of attack on the subject, and that presents even more difficulty. It might be possible, if we could devise some reasonably cheap means of dealing with stone before it is put into a building, to do something which we have not attempted on any scale—that is, giving it a bath of some preservative: it might be one of the silico-fluorides. If we could, at a reasonable cost, tackle stone in that way, we might go far towards getting almost perfect material.

But, in the end, when all has been said and done, the question of cost always comes in. You have a well-defined difference between granites, sandstones and limestones, and you know that if you want to put in something which will last well for a long time, you employ granite; when it is a question of material which will be lasting, there is granite ready to your hand. But you cannot pay for it, and that is the difficulty all along; that is the bed-rock of half the architect's troubles. The architect says "I would like to put in so-and-so, but my client will not stand its cost." I have very much enjoyed Mr. Munby's address, and I would like to take this opportunity of saying that anything our Department—the Geological Survey—can do towards the objects outlined to-night we shall be only too glad to undertake.

Mr. H. D. SEARLES-WOOD [F.], Chairman of the Imperial Institute Timber Committee, rising at the invitation of the President, said that his Committee had very great pleasure in furnishing the samples of wood on the table. Dr. Chandler who was present would explain them to anybody who examined them after the meeting. With regard to the Timber Committee at the Imperial Institute, it was their intention to have an exhibition of the timbers that they had selected from various sources, and the information that they would give about the uses and the new sources of supply would be of the greatest interest to members of the Institute. It gave him very great

pleasure to support the vote of thanks to Mr. Munby for his admirable Paper.

The PRESIDENT, in putting the motion, said: The duties of an architect cover an enormous field, perhaps a wider field than that of any other profession. Let us be thankful that the watchfulness of Providence extends over an equally wide field, looking specially, we are told, on children and sailors, and, no doubt, architects, preserving them from falling when they get into difficult places. With regard to the materials, lime and cement, which have been alluded to, I think much turns on the question of lime *versus* cement in brick-work, when a failure in a modern building results in a crack. I think that is largely because of the extensive use of cement, a rigid material; whereas in the old days, when we built of lime, there was always a certain elasticity and adaptation of the structure to the slightly varying circumstances, to which it must conform, either by alteration in shape or by cracking. The tests we have been hearing about are all, if Mr. Munby will allow me to say so, too elaborate for the ordinary working architect. But we urgently want an authorised series of simple tests for the ordinary clerk of works. (Hear, hear.) We have, as you know, all sorts of rough-and-ready tests. I was extremely delighted to find that our old preference for the hand-made brick and tile is fully justified, and that the wretched pressed-brick and tile are very bad and soon decay. We shall rub that into our clients, because hand-made bricks are expensive just now. There is one question I would like answered by British scientists, and that is, why British-made glass is green. If you turn British window plate-glass on end you see it is a dark green. I have had the good fortune to build several picture galleries for the exhibition of delicate works of art, and I have been obliged to go to Belgium or to France to get white glass. You cannot show delicate water-colours under glass which is green in section without manifest detriment. I cannot understand why we do not produce a decent white glass in England; is it a matter of cost? We want simple tests and simple remedies. The question as to the cause of dry-rot is a botanical one; it does not interest us a bit; what we want to know is how to get rid of it, and we want to know that at once. My own rough-and-ready method has been to cut out all the affected parts as far as possible, burn the material, so that the fungus shall not be conveyed in other directions, and then to thoroughly wash all the work around, as far as it could be reached, with a dilute solution of corrosive sublimate. I do not know whether that is good or bad, but it seems to cure it, for there has been no recurrence of the mischief after that drastic remedy. It would be of enormous benefit if the Chairman of the Science Committee would turn his great energies to the production of a small handbook for the use of clerks of works and ourselves, showing simple and effective tests for the materials we have to deal with, and also some remedies that we could apply for minor defects which occur in buildings.

Mr. MUNBY, in responding, said : While I am very grateful to the proposer and seconder of the vote of thanks, I am sure that any pleasure and profit to be attributed to this evening is due firstly to our guests, and secondly to the organising ability of our Secretary, Mr. MacAlister. May I relieve the monotony of my remarks by one anecdote to show that those who have no use for science are at least in very pleasant society. Calling on a scientific friend the other day, he mentioned to his wife with some pride that their small boy was showing a taste for experiment. The lady's reply was unexpected. "Well," she said, "anyhow, it is your fault." This enables us to understand the ungracious attitude towards the sex of Wren's Oxford Professor. We have had evidence to-night that our scientists are very learned, but they are also really very human people. I remember the late Lord Rayleigh telling me of a visit he paid to a laboratory of a scientific friend, and one thing seemed to have impressed him more than anything else. He said, "I opened a drawer which was labelled 'Corks,' and there were corks in it!"

Mr. ALAN W. DAVSON, F.S.I., writing since the meeting, says :—

My interest in the question of research is more in relation to "individuals" than "materials." Nevertheless, the two are interdependent. The more certain we are of the precise nature of materials used, and their action under varying conditions, the more certainly can we educate and train individuals to the best methods of usage and to careful selection of materials for particular purposes. To-day the architect is crowded out with every conceivable variety of material. Some may appeal more to the eye than others, yet those which appeal less to the eye may be more desirable and useful for practical purposes. The architect or surveyor knowing this invites to his aid some expert in research, and is carried away with enthusiasm at the arguments in favour of a special material, only to place the same question before another research worker whose ideas appear to the uninitiated largely contrary, though they are not necessarily so. This fills the enquirer with despair, and he is inclined to return to his haphazard methods and trust to luck. Nevertheless, pure research is at the basis of progress, and applied research the connecting link between it and practical utility, whether in relation to materials or individuals. The haphazard choice of materials and men in the past for particular jobs and particular types of work respectively is largely responsible, in the opinion of the present writer, for much of the industrial unrest existing in the building industry and all industry. It is by such papers as Mr. Munby's, which bring to light the essential value of research, that it may be hoped, the empirical nature of the Englishman will be overcome, and be replaced by a greater desire for and belief in "scientific method."

Mr. E. B. MOULLIN (School of Architecture, Cambridge University) writes :—

May I take this opportunity of thanking the Institute for giving me the opportunity of hearing Mr. Munby's most interesting and instructive Paper. Mr. Munby referred to the wide range of knowledge required by an architect, and the illustrations to his Paper and the discussion strongly emphasised this point. In the short span of human life it is clearly impossible for any one to become equally conversant in so many subjects. Hence it seems inevitable that the detailed scientific research into new building materials, and into the failure of existing ones, must be largely carried out by those who have had the long scientific training necessary for the purpose.

But for this scientific work to be productive and useful the suggestions and inspirations must always come from practising architects. In order that this partnership may be effective, it is necessary that the architect should have a wide education in the general broad principles of science, and that his training should help him to give accurate and unprejudiced descriptions of his experiences to his scientific collaborator. He must be able to give a reasoned and detailed criticism of the success or failure of new materials and processes; be capable of properly analysing and observing failures, and of making the correct deductions as to their cause. The advantage of this faculty is well illustrated by Mr. Munby's example of many cases of dry rot being caused not so much by faulty timber as by such a simple matter as badly conceived rainwater pipes.

At the Cambridge University School of Architecture much importance is attached to the teaching throughout the whole course of the mechanics of building construction and the properties and manufacture of building materials. And this teaching is carried out in such a way as to do everything possible to assist the student to form an analytical habit of mind and to make a mental and descriptive estimate of a problem before proceeding to an exact and numerical solution.

It is every member of the nation who benefits by improvements and economies in building, and consequently financial support for research must come from the public purse, in order to assure that the benefits thereby attained are a national asset and not merely a commercial profit to some firm. What Mr. Munby has said about improvements in lime is particularly interesting to me, and I should like to suggest that this is one of the really outstanding needs at the present time, in order that so much expensive misuse of Portland cement may come to an end. The photographs Sir Richard Grazebrook has shown of concrete blocks split by leakage currents are very suggestive. This is bound to be a further risk, apart from that of fire, of the use of electricity in concrete buildings. But if the earthing and bonding of the protective case of the wires is properly carried out, it is impossible for this to occur. I know from experience that the earthing and bonding in buildings is seldom above reproach.

One of the speakers suggested R.I.B.A. specifica-

tions for various things. It is well to remember that there is already a most excellent wiring specification by the Institution of Electrical Engineers, and if architects will do their best to insist that wiring is carried out strictly in accordance with these rules it will be an advantage to all concerned.

Mr. W. E. VERNON CROMPTON [F.] writes :— I was sorry to be unable to remain until the close of the discussion upon Mr. Munby's excellent lecture ; perhaps, therefore, I may now be permitted to suggest that one of the principal things that requires thinking out is the organisation necessary to link up the architects, or for the matter of that the whole of the building activity of the country, with the technical experts.

The Science Standing Committee of the R.I.B.A. is doubtless fully aware that owing to the increasing complexity of our civilisation it cannot now be expected to carry out direct research or express opinions upon many of the difficult and far from elementary problems that are brought under its notice ; it is, therefore, essential that there should be some organisation in existence available for the R.I.B.A., through its Science Standing Committee, whereby these varied problems may be brought before the appropriate research association. The *liaison* between these two bodies, at present so feeble, requires strengthening, and where deficient it requires organising, so that the R.I.B.A. and similar bodies could bring their problems before the appropriate scientific expert for solution almost as a matter of right.

During the early days of war, a Research Committee was appointed, first as a Sub-committee of the Science Standing Committee, and afterwards as a direct Sub-committee of the Council, to consider and report upon this matter, and in their report to the Council this committee advised among other things the desirability of further research on dry-rot, glass for pavement lights, and corrosion of ferrous and non-ferrous metals. Early in 1916 some members of this Research Sub-committee attended at the offices of the Board of Education, and met the recently appointed Committee of the Privy Council for Scientific and Industrial Research, under the chairmanship of Sir William McCormick, before whom they laid their case, and asked that the above-mentioned subjects should be earmarked by his committee as subjects which should receive attention and financial assistance.

Our Research Sub-committee continued its endeavours and ultimately made some progress with reference to the corrosion of non-ferrous metals, and in 1918 it was instructed by the Privy Council Research Committee to get into touch with the Institute of Metals. A definite committee was therefore formed, consisting of three members of the R.I.B.A. and some members of the Institute of Metals, with Mr. Munby as chairman. They had several meetings and formulated a scheme. Having succeeded in obtaining guarantees of about £350 per annum for two or three

years, to which fund the R.I.B.A. contributed, they approached the Privy Council Research Committee again, with a view primarily of obtaining further financial support on the basis of £1 from the Privy Council Committee for every £1 collected privately.

After various delays and critical periods in the negotiations, which undoubtedly added a phase of excitement to the work of the committee, the Privy Council Committee decided that the work should be continued by the British Non-Ferrous Metals Research Association. At first it seemed as if the spade work having been done by the R.I.B.A. and the Institute of Metals, another body was instructed to proceed, with headquarters at Birmingham, where it was anticipated the research work would be carried on : but eventually matters were so organised that four members of the British Non-Ferrous Metals Research Association joined the original Committee of the R.I.B.A. and Institute of Metals, and the Research Chemist, appointed last February (some five years after the matter was started by the Science Committee of the R.I.B.A.), has been transferred from Birmingham to London, to work under Professor Carpenter at the Imperial College of Science and Technology, where he will be in touch with other types of corrosion.

The cost of this research is nearly £800 per annum, but it is hoped that in a few years something will be evolved that will prevent objectionable oxidation of electric and gas fittings and other brass work, so disgusting in appearance, and will save domestic servants and other people consuming millions of hours per annum and gallons of metal polish in their efforts after cleanliness and decency.

I venture to suggest that if the R.I.B.A. could initiate and carry through to a like conclusion research into dry-rot and the acoustics of buildings, they would be conferring a public benefit.

Mr. HENRY W. BURROWS [A.], F.G.S., writes :

The lateness of the meeting on the 18th April prevented me from taking part in the discussion of Mr. Alan E. Munby's most informative lecture, on which I beg to be permitted to make a few notes.

Building Stones.—The slides showing the action of weathering on some of our commonest building stones exposed for the past ten years on the roof of the Geological Museum in Jermyn Street were particularly noteworthy. They confirm the views expressed about thirty years since by my friend the late Geo. F. Harris in the many articles from his pen in the pages of *The Builder*. They confirm, too, the opinion, expressed in my paper on the *Examination of Building Stones* read before the Institute in the year 1893, that "the nature of the cementing material and its disposition around the particles of which the rock is formed . . . should be the chief objects of our inquiry." The examples shown at the lecture clearly demonstrated this, for the oolitic granules stood out clear and distinct from the matrix which had been etched out by the weathering of the past ten years.

The late Mr. F. W. Rudler, the then Curator of the Geological Museum, in 1893 suggested the desirability of making "an investigation of the principal stones that come into the market," with a view to "schedule . . . the results obtained from chemical, from mechanical and from optical examination." It is, therefore, particularly gratifying to learn from Mr. Allen Howe that we may soon expect to have such a schedule, which will be welcomed by every architect in this country.

Defective Roofing Tiles.—The Science Committee of the Institute invited me to make a preliminary examination of several defective roofing tiles sent by architects from various parts of the country. In order to form any reliable idea of the probable reasons for the failure of these tiles it seemed to me that we ought first to endeavour to ascertain—if it were possible—the chief characteristics of tiles of proved durability. To that end I collected and examined several old hand-made tiles, some dating back to Roman days, including tiles made from sandy loams (Fig. A), and those made from almost pure clays (Fig. B). All these old and durable tiles, so far as I have yet examined, have one particularly striking character in common. They all have numerous *air-pores* throughout their mass; whereas in the defective pressed tiles so far examined air-pores are lacking. This one fact may prove to be of the utmost importance, although it is impossible to generalise on the subject until many more specimens, good and bad, have been examined.

It would be rash, indeed, to assume that all hand-made tiles are reliable merely because the old hand-made specimens dealt with have proved to be exceedingly durable. Among the defective tiles is a modern hand-made specimen from the Midlands which has failed lamentably. So far as the material is concerned it appears to possess all the characters of a durable tile, and air-pores are abundant. The tile, however, is very roughly made, and the defects appear to be due to the manufacture, not to the material. Many architects, too, could testify to the fact that the pressed tiles of thirty to forty years ago have weathered well, which again suggests that durability depends at least as much on manufacture as on material.

It is sometimes thought that the failure of tiles may be due to the presence of carbonate of lime. In the defective tiles examined there is barely a trace of it. Here we need the help of the chemist; but, so far as I can at present determine, the white, or biscuit-coloured, material in some of the tiles tested is apparently not calcareous but felspathic. Whether or not this substance becomes *kaolinized* in burning, and so liable to expansion and consequent splitting of the tile, is one of the points requiring very careful study.

The tiles have been tested for the *rate of absorption*. It appears that but little dependence can be placed on this test *per se*. Tiles (like Fig. A) made from sandy-loams absorb more than those made from clays (Fig. B). It would appear that we must compare tiles class by class, just as with building stones it is neces-

sary to compare limestones with limestones, sandstones with sandstones, and so forth.

In illustration of this point it may be noted that tile A absorbed 7.5 per cent. of its dry weight in one hour. The pressed defective tile (Fig. 2) absorbed only 4.2 per cent. in one hour; while a thoroughly good tile (Fig. B) absorbed exactly the same percentage in the same time!

A rule-of-thumb test is to strike the tile to ascertain if it "rings" well. This test, too, appears to be delusive, for some of the defective tiles ring as well as or better than those of proved durability.

The Science Committee are anxious to study this matter of defects in roofing tiles as fully as may be possible. To insure any approach to success it will be necessary to adopt a systematic scheme. Tile works should be visited with a view to studying the material used and the processes of manufacture, and chemical, physical, and microscopical examinations should be made. If the subject is to be properly investigated it will, doubtless, prove to be a long, laborious and somewhat costly business.

I venture to suggest that this matter of defective roofing tiles is one that really concerns manufacturers more than architects, as we are entitled to expect an article that shall prove to be durable. If this be so we may reasonably look to tile-makers for their cordial co-operation in elucidating a problem which is alike to their interest and to ours.

Note.—The density and minute structure of the tile matrix makes it extremely difficult to obtain satisfactory transparent sections. The figures show transverse *solid* sections, the full thickness of the tiles. All were photographed under the microscope by reflected light. All are magnified 6.5 diameters.

H. W. B.

Testing Steel and other Metals: Demonstration at the Institute, 6th June.

The Science Standing Committee are arranging for a demonstration before the Institute of a machine for rapidly testing steel and other metals. The Committee consider that it would be particularly useful to members who have to test small specimens of the steel which is being used in the construction of their buildings, and it would be of great assistance to District Surveyors in the discharge of certain of their duties. Usually tensile tests are only made when definitely specified as part of the contract, or in case of dispute; the purchaser has to rely on the statements of the people who supply the material. There is consequently a field in workshop practice for a simple test (requiring only a small amount of material and a test piece of simple form) which can be rapidly carried out, and which, even if it has not the high order of accuracy of the tensile test, can nevertheless be relied upon. The demonstration will take place at the General Meeting of the Institute to be held on the 6th June.



A



B



1



2



3

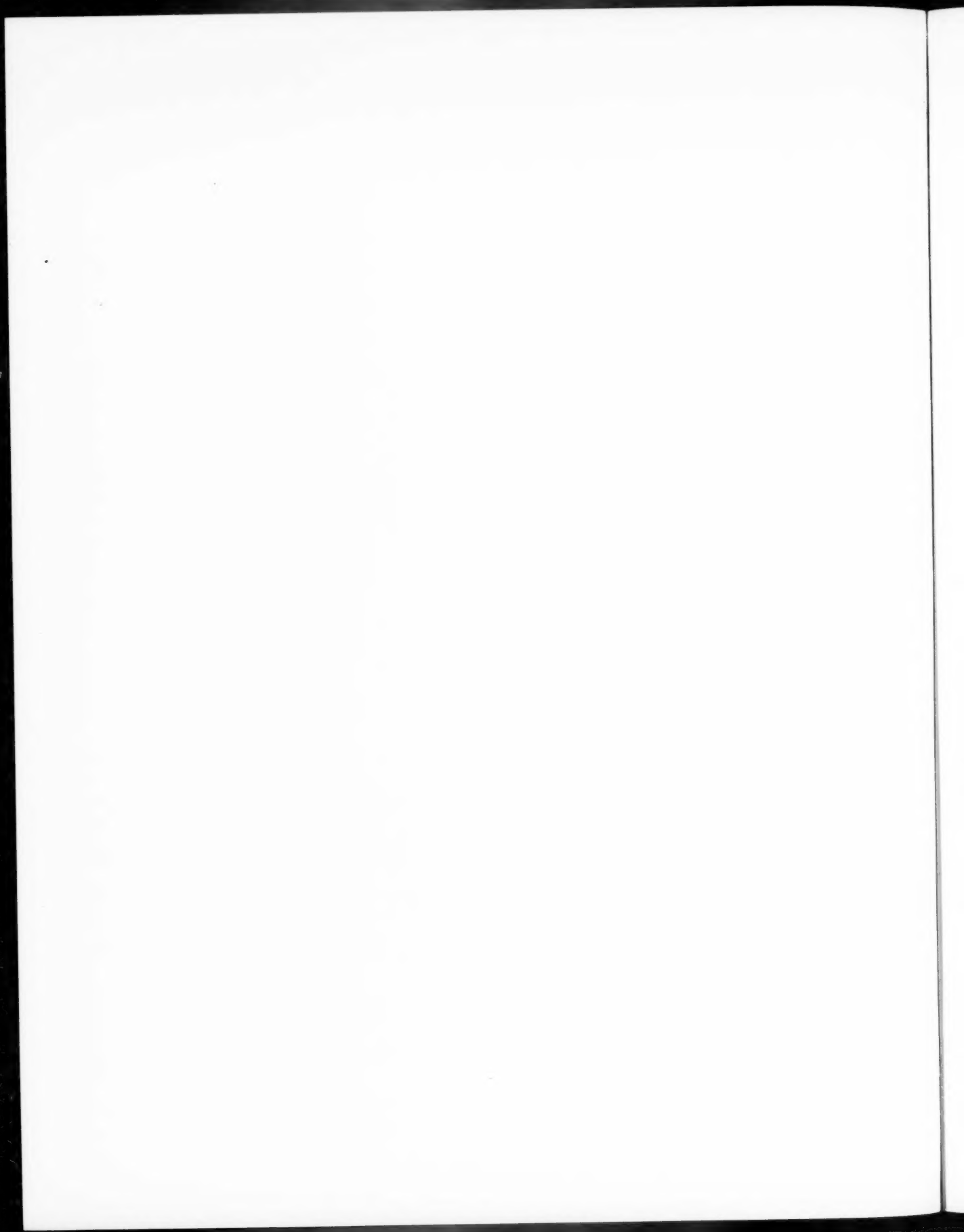


4

Micro-Photo by H. W. Burrows

Magnified 65 diameters

MICROSCOPIC STRUCTURE : ROOFING TILES



CHARACTER IN MODERN ARCHITECTURE.

By Prof. C. H. REILLY, O.B.E., M.A. Cantab. [F.].

Paper read before the Liverpool Society of Architects,
24 November 1920.

THE main sources of character in architecture would appear to be the same as in the individual human being. They may be divided in both cases into the categories racial, individual and acquired. To these some would add the dictates of fashion. Architecture, or the best architecture, however, suffers less from the vagaries of this tyrant than do the other arts. The man who will design a permanent structure and trick it out with fashionable detail, not to answer any need for expression, but because he has seen some such detail in the building papers, is not a serious artist. He is a *poseur* as much as the man who wears a special cut to his clothes in the hope that thereby he may be thought to be a person of some distinction. It is not the work of such men that we would wish to consider. That there is a great deal of it to be seen no one will deny. Every competition reveals it, our streets overflow with it, yet, nevertheless, we know that in the long run it is negligible.

Let us take, then, the main ingredients in order and consider first the racial contribution. All through the history of past architecture building forms have been among the most distinctive national products, and the older the buildings the more distinctive do their forms appear to us. As intercourse between nations has increased, shapes, and the ideas they embody, have been gradually assimilated until they have taken on the tones of the native architecture, and in the end have become inseparable from it. It was in this way that the architecture of the Italian Renaissance permeated French and English work. In all the earlier importations no doubt the French or English architect thought he was building something entirely Italian in the new and fashionable manner, but local tradition was always in the end too strong for the innovator. The result was a French or English variant of an Italian theme. Take even extreme cases like the Earl of Burlington's villa at Chiswick. This was indeed supposed, at the time of erection, to be a copy of Palladio's similar villa at Vicenza. We now realise how anglicised a version it is. Inigo Jones's Banqueting Hall, although it marked a departure in England almost as bold as Brunelleschi's Pazzi Chapel in Florence, is a very different building from one which Palladio himself would have erected in Whitehall. Even the imported Italian architects, when it came to whole buildings and not merely monuments, were at once under the same sway of local feeling and methods. Leoni's Italian front to Lyme Hall, Derbyshire, is not so very different from the many other so-called Palladian buildings erected by Englishmen at the beginning of the eighteenth century. But this power of absorption, whether based on national conservatism or sheer ignorance (sometimes its equivalent),

is less powerful to-day, and on the whole I think we would have it so. Where the practical conditions are similar a good modern building might now be almost equally at home in any European capital, with, perhaps, the single exception of Paris. Paris is more distinctively national in her new architecture than any other capital city. All nations, however, feel her influence, and especially those across the Southern Atlantic. Through her highly organised and centralised Ecole des Beaux-Arts she still wields an immense power, but against her a new competition has arisen. America is the new power in world architecture, and she is a power which makes for cosmopolitanism. Just as she herself is the product of many races so is her architecture. Her great designing groups, like the firm of McKim, Mead and White, draw their inspiration from all classical and post-classical sources. They are Roman when they want to express power, as in their great railway stations, Greek when they want to express refinement, as in their art galleries and museums, Italian or Georgian when they want to express the domestic comforts or virtues. The great American architects are the heirs of the Old World, and well are they using their heritage. Further, the wealth and potentialities of their country mean that their architects have had to tackle and solve such problems as the high building and the giant hotel before those of other nations. We shall all come to such things, but they have reached them first. The result is that in such matters they have already largely settled the type and character. The influence, therefore, of America, as her work is more and more known, is likely to make for a decrease in nationalism. Through her example we too shall become heirs to the world's architecture, unless, indeed, the rank growth of nationalism, which is one of the unfortunate effects of the Great War, reinvades the domain of art and each nation is thrown back again on its primitive forms. On the other hand there is this danger in this new cosmopolitanism, which even so good a building as the Cunard Building, Liverpool, exhibits, that we shall have in one and the same building a mixture of conflicting detail. French, Italian and Greek may be found together imperfectly fused. That may be the necessary concomitant of any transitional period. It is one, however, which greater knowledge should gradually overcome.

Let us look at the matter from another angle. The history of the architecture of any nation since the Renaissance may be considered to be a gradual absorption of foreign elements. Our own Renaissance architecture, since the immature early period, has been ably divided into the following divisions by Professor Richardson; the first Palladian period, including the rough Palladianism of Wren and Inigo Jones, the second Palladian period when Palladio's ideas were more completely absorbed, the Roman Palladian period when men like Adam went behind Palladio to Roman sources, the Græco-Roman phase when Greek detail was gradually brought in, the pure Greek phase, and finally the neo-Grec and Italian phase, when for a time our archi-

fects, like Charles Barry and Cockerell, proved themselves worthy inheritors of the complete classical and post-classical past. This evolution, if looked at as a whole, is one of clarifying the stream and getting back to its true sources. French architecture went through a similar evolution. What I take to be happening now in America, and what I hope will happen to us too, is that this same process of absorption and clarification will be applied to all modern classical architecture, and that as a result a new international architecture will arise in every country. In our hearts, even if we have a little natural jealousy, we see no incongruity in the great American building which is in the course of erection at the present moment at the bottom of Kingsway, London. Most of us really welcome it as a building which will influence our own work for good. It is interesting to recall how we have in our time and in Liverpool seen this process of absorption and clarification carried out. In the last twenty years we have recapitulated, as it were, the history of the last two hundred. Twenty years ago most people were doing the kind of work Sir T. G. Jackson and Sir Aston Webb won their spurs with; that is, small scale Early Renaissance work in which the Orders, if used at all, were used as ornaments to structures essentially Gothic in spirit. That corresponded to the Elizabethan and Jacobean stage. One example in Liverpool not more than twenty years old is the façade to St. John's Market. Then in natural sequence followed the Wren stage of fat unfluted columns and somewhat heavy detail. The Dock Board Offices and Technical School, Liverpool, are examples of this. Then followed the Neo-Grec movement, which was pushed by certain of our schools of architecture with the quite definite intention of purifying detail and adding elegance to design. Of this stage the West African Bank, Liverpool, and the interior of the Cunard Building are conspicuous examples. The difference in refinement and strength from the buildings of the preceding stage is obvious to anyone and yet the buildings are by the same architects, for instance the Dock Board Building and the West African Bank, the University Club and the Cunard Building. The exterior of the latter indicates the next and present stage, when to complete classical proportions and scale are added contributions from the Italian and French Renaissance. Gradually, then, in Liverpool, as in America, the best architects have again reconquered the whole field, just as Barry and Cockerell had for another generation. They have done for Liverpool what America has done for the world. The great post-classical styles are now consciously used according to the programme set for the definite expression each can convey. As nothing in art stands still let us hope that the same high standards will be applied to all future buildings whatever their use, and that we shall have no more harking back to imitations of those past periods when knowledge was not so complete as it is to-day; or if it has to be done at the whim of some client, let it be done as Professor Adshead has suggested, consciously, as a definitely planned anachronism

complete in all its parts. If we have to put up an Elizabethan building it should be done thoroughly as a conscious exercise in a past style.

Let us now turn to the element of individuality in modern architecture. This is a much more difficult and debateable point. During the last fifty years I should say we have suffered from an excess of individuality. We have had too many secessionists. Certainly we have in domestic work, and their influence has been unsettling. It is a great relief to me to see in the numberless housing schemes of the present time that the influence of soberer men like Ernest Newton and Adshead is on the whole prevailing. The work shows a return to tradition instead of a violent break from it. But, after all, architecture is effected from the top not from the bottom, and the trend is determined by monumental buildings, not by cottages. Can an ordinary man working in the modern universal monumental manner already mentioned show the individuality, say, of the late E. A. Rickards? Rather is it right that he should? I should, a little hesitatingly, say no. If he does express his own individuality to that extent, so far, however great an artist he may be, he is not in the main stream, he is not advancing the architecture of his age. I realise this will seem a hard saying, and it certainly requires some justification. No one was a greater admirer of Rickards's work than myself, no one had better opportunities of knowing how strictly in his case the work was the man. At his death a famous critic said what a pity that Rickards with his special gifts of rhetorical architecture was never commissioned to build a theatre or a picture palace, but had to be content with town halls and churches. To this an architect friend replied that that made no difference; he never built anything but picture palaces—and there was a great deal of truth in the answer. Whether it was the Wesleyan Hall at Westminster or the Town Hall at Cardiff, Colnaghi's Gallery in Bond Street or the Third Church of Christ Scientist in Half Moon Street, we have the same Baroque detail, the same extravagant yet vital Baroque spirit. It is not so much that these buildings do not express their varied purposes—that they sin against Mr. Ruskin's dark lantern of truth. That is to my mind a comparatively small matter. The great Jesuit Churches of the Baroque period in France and Italy would to-day make marvellous cinemas, and are thereby none the less fine works of art. The point is that these buildings of Rickards's are so entirely personal to the man himself. They can have no real successors. We may have, and we probably shall have, a few feeble imitations, but Rickards's art was a personal art and died with him.

The great buildings of the world have always belonged less to the individual architect and more to the age in which they have been built. In the same way the architect of to-day must be willing to sink himself in a greater whole; to lose his soul to find it. This is the history of all the great periods. We talk of Ictinus and Brunelleschi, of Inigo Jones and Mansard, but we

think of the whole phase of buildings for which these men stood. Liverpool perhaps offers one of the best or worst examples in the world of excessive individualism in architecture. I refer to the group of the three big buildings at the Pier Head. No one looking at them as a group, whatever their respective merits or demerits, can fail to realise their gigantic disharmony; a disharmony in the main brought about by the excessive individualism of their designers. Although these buildings were all built within the last fifteen years, and all for similar purposes, the architect of each was practising at the time in a different phase of the post-Classical tradition, though I am not quite sure whether even that phrase can be stretched to cover the Royal Liver Building; let us take this building first and try to analyse its character as it appears to the ordinary man. For the architect of course it is a mass of incongruities, but to the man in the street it is rather a romantic pile. A mass of grey granite to the cornice, it rears into the sky two quite unnecessary towers which can symbolise nothing but the power of advertisement. It is only your hard-headed business man who can waste money in this light-hearted way. It appears that if you promise him a clock that is bigger than any in the world he will build, not one, but a couple of unnecessary towers in which to house it. Yet this building, towers and all, with its coarse and commonplace detail, has a certain brute force combined with its romantic character. In place of elegance and refinement it offers to the world a bold sentimentality not unlike some north-country types of people. It seems to say "I am a great awkward sentimental creature unused to civilisation, but I have strength, and whether you laugh at me or not I shall get what I want."

The Dock Board building at the opposite end of the group is of an entirely different kind. Its great and finely outlined dome with four subsidiary domes follows closely the composition of the Belfast City Hall, which preceded it by a few years. Its character, by the association of ideas which a central dome calls up, is civic rather than commercial. The detail of the building with its numbers of large unfluted columns seems to emphasise this. Such a building should, of course, have had a central site. A great dome raised on a drum should always mark a focal point in the city's plan, and should be reserved for its most important building. In America such a dome connotes the City Hall or Parliament House. In the Old World, except for Belfast, it has generally been reserved for a great cathedral. Here, therefore, we have a totally different character from that of the Liver building.

In the central building, the Cunard Block, we have a character differing from either, though like the two others it is a commercial building, designed in the main to house the offices of a single big company. Here, however, we have a sober solid block, simple in outline, which on closer inspection reveals a great amount of fine detail, varying a little perhaps between Italian and French, but expressive and sincere enough. The whole gives the impression of an Italian Palazzo well suited by historical association to a city block. If one

may venture on the comparison, the Liver Building is as obviously plebeian as the Cunard is patrician, even if a little doubtful of its descent, whereas the Dock Board, because it appears to use clothes which belong by tradition to another walk in life, one might perhaps, without offence, call *nouveau riche*. However, the point I wish to emphasise is not the character of any one building but the diverse character of all three, and the way the town as a whole suffers by it. Obviously if there had been any great restraining tradition as in the culminating periods of architecture, no such diversity would have come about. It may be replied that the three unequal sites helped to bring about the three unequal buildings—to which I should answer that if we had been under the thralldom of a really vital tradition the unsymmetrical division of the sites would not have been possible any more than the individualistic character of the resultant buildings.

This brings me to my last and final point. In the absence of tradition how, for the general good, are we to restrain the individualism from which we are suffering? Abolish it we cannot and would not. If we did the architect would cease to be an artist and become a machine hack. The answer, I think, must be the answer a parent or schoolmaster would give with regard to the character of a child. It is comprehended in the one word "training." It is the boast of our public schools that whatever sins of omission they may commit in education they do at least train character. They do it, too, by placing the boy in certain obvious predicaments, such as membership of a team or being prefect of a house where a definite standard of conduct has been laid down. Now in the complicated and self-conscious art of modern architecture it is only by a knowledge of the precedents established by past forms for certain predicaments that the ordinary architect can hope to give the right character to his buildings. It is a knowledge hard to obtain in these days of eclecticism where so many possibilities are open to him. One cannot any longer be content with blindly following the work of one's contemporaries, as in the ages of tradition or faith, for that in itself derives from all sources and is as varied and heterogeneous as the colours of the kaleidoscope, without, too, the remarkable faculty the pieces of glass in that instrument have of falling into a definite pattern. If you shake the kaleidoscope of modern architectural forms you are at present as likely as not to get a group of buildings like the group I have described at the Pier Head, Liverpool. In the days of faith things were, of course, different. Tradition made the various pieces come together. One forgets how recent those days were. Think of Rodney Street, Liverpool, or Regent Street, London; of the London squares or the Liverpool ones. But in architecture, as in other spheres, faith to-day must largely be replaced by knowledge. Knowledge cannot give the same sublime confidence, but it does prevent blunders. It provides in architecture an alphabet and language of immense range and pliability ready for use. It is a language rather like Chinese, in which a separate symbol stands for each word or

phrase, and which is consequently rather difficult to learn. The complete range of it in modern times has only been mastered by a very few, for it is a language, too, which is always growing. The group of artists, numbering by now several hundred, known as McKim, Mead and White of New York, are amongst these few, as the great monograph of their work, recently published, shows. They not only know the complete language, but they themselves have added many phrases to it, such as the Boston Library, which ever since its erection has helped to form the true library character, just as the Opera House at Paris has formed the true opera house character. Perhaps modern conditions of architecture will tend towards the establishment of similar groups in England as that of McKim, Mead and White, whose work goes on with equal success, although McKim and White are long since dead, and Mead is now an old man. If so it will be a reversion to the ways in which the great cathedrals were built. In those days the architect as a separate personality had hardly emerged. In the future his personality may again be merged in that of the group, though he will now have to know a great deal more. While he may lose something as an individual, not only the world but he himself will gain a great deal. For the world the gain may be that the violent contrast and clash of the modern city may disappear. For the architect, instead of shutting himself up in his own office jealously guarding his ideas from his colleagues until executed, he will have the stimulus and criticism of a number of his equals. Of course occasionally the brilliant personal note, like that struck by the late E. A. Rickards, will be sounded. But on the whole I think the complexity of the business side of modern practice alone will tend to amalgamations among architects of similar knowledge and tastes, and these amalgamations will of themselves lead to a higher technical accomplishment, just as they have already done in America. In the days of ignorance, which in architecture followed the days of faith, it required little courage to be an individualist. Fools rushed in and built foolish buildings. In the days of knowledge which are to come, the individual will not be so anxious to exploit his own personality. Having the standards of all the past to go by, his first thought will be not to fall behind those standards. This alone is a sufficiently difficult task to make him feel the need of colleagues for help and criticism. It is a far happier and a more profitable state for most men to feel that they are part of a great movement than to be isolated prophets crying in the wilderness and using a language which no one understands.

Books Received.

- A History of French Architecture, from the death of Mazarin till the death of Louis XV.—1661-1774. By Sir Reginald Blomfield, R.A., Litt.D., M.A., F.S.A. 2 vols. 40. Lond., 1921. £4 4s. net. [G. Bell & Sons, Ltd.]
- Laboratories: their Planning and Fittings. By Alan E. Munby, M.A., F.R.I.B.A., Author of "The Chemistry of Building Materials." With an Historical Introduction by Sir Arthur E. Shipley, G.B.E., Sc.D., LL.D., F.R.S. 40. Lond., 1921. 25s. net. [G. Bell & Sons, Ltd.]

REVIEWS.

THE PHILOSOPHY OF ÆSTHETICS.

The Things which are Seen: Revaluation of the Visual Arts. By A. Trystan Edwards, M.A. Oxon. [A.]. 80. Lond. 1921. 18s. net. [Philip Allan & Co., Quality Court.]

Every artist who takes his art seriously has longed at some period of his career to put into adequate language his confession of faith; to be able to explain himself and his art, and to confound his critics with irrefutable logic. Especially is this the case at the present time, essentially a period of searching criticism in which all professions are put to the test of reason. Unfortunately, all are not gifted with the divine gift of tongues, and though they may feel that as artists they fill a very real place in a civilised community, they have not the ability to state these reasons clearly and convincingly. Mr. Edwards has this gift of language, and he has triumphantly used it for the benefit of his fellow craftsmen.

To cover the whole range of the philosophy of æsthetics (as applied to the visible arts) in the way Mr. Edwards has essayed is a task of gigantic magnitude that might well intimidate the boldest. His book is intensely exciting, even provocative, and is one which will inevitably rouse a good deal of hostility. Very few people, Englishmen possibly less than most, care to be made to think against their will. After a time they may find the process stimulating, but the first effect is one of confusion and the second that of anger.

Mr. Edwards's book, with the deceitfully harmless appearance of its title, is like a bombshell dropped into a group of slumbrously inclined gentlemen, accustomed to take their leisure and their arts easily—so it is little wonder if the hastily awakened critics should display their annoyance in bull-like (one might almost write "John-Bull-like") roars of disgust.

The book is divided into three parts: the first part "The Hierarchy of the Arts"; the second, "Form and Subject"; the third, "The Human Agent."

In "The Hierarchy of the Arts," Mr. Edwards takes as his main theme the proposition that the happiness of the average man is the ultimate test of life and art, and that in so far as the arts promote this happiness, they are justified and to be encouraged. Mr. Edwards's contention that human beauty is the natural expression of human happiness, may come as a shock to this industrialised generation who have travelled so far from the Greek viewpoint. It is, nevertheless, profoundly and indubitably true. That human beauty, manners and dress should be considered as arts at all, comes as a refreshing surprise to many of us who have been used to a rather narrow interpretation of the word.

The chapter on "Manners" is peculiarly delightful. It is written with a quiet humour that is as effective as it is disarming—before one is aware, the guard is down and the delicate rapier-thrust has gone home. It is when Mr. Edwards treats of sculpture and painting, which he describes as the minor arts, that he

appears to be on more debateable ground. True, we are not obliged to look at pictures or at sculpture, whilst we are forced to regard the architecture of our streets. Neither are we obliged to read poetry—though we must read the daily newspaper—nevertheless the poet may in his moment of exaltation give forth a truer message and one of greater value to the human race in a few short lines, than can whole reams of prose—though, let it be said, this is not used as an argument to excuse slipshod prose. Similarly, architecture may at its highest be as lyrical as any painting or piece of sculpture; but this does not detract from the value of sculpture and painting. Comparisons are odious and hierarchies are difficult of determination, but Mr. Edwards's selection serves a useful purpose if it will convince us that painting and sculpture can only suffer if they are to be petted and exalted at the expense of the other arts, in place of being contributory and complementary to them.

Probably to an architect the second portion of Mr. Edwards's book will not be so interesting or so convincing as the first and third parts—chiefly for the reason that the architect is more familiar with the subject. The chapter on "The Grammar of Design," which forms the greater part of the second section, is, nevertheless, well worth perusal even by the architect who is familiar with Guadet's teaching—he will find much to ponder and reflect on, though he may not agree with all the analogies and propositions set forth. What will particularly delight him is the way that those subtleties of design, which it is so much easier for him to feel than to explain, are hauled forth into the clear light of reason for the enlightenment of the lay mind.

After a good dose of the "Grammar," the most stubborn of Philistines would hesitate to proclaim that "he knew what he liked"—he might even be brought to the position of admitting that he knew very little, and that his likings, except so far as they were innate and not vocal, were of slight importance. Mr. Edwards omits nothing, he traverses the ground with an almost painful meticulousness, his rage for definitions is even at times a little wearisome; but it must not be forgotten that the author is addressing himself primarily to the general public: that is, to readers who will, for the most part, be entirely ignorant of the elements of design, let alone the grammar. Again, it must be remembered that Mr. Edwards writes as a philosopher: that is, one who accepts nothing without proof, and who applies the test of reason to every proposition. He defines his attitude in the closing sentence of the chapter on "Aspects of Subject" in these words: "Avoiding all intellectual hazard, I have confined myself to simple and obvious statements, not being ashamed to be as cautious as a mariner who would choose the safest possible route across dark and dangerous waters."

One word in warning. There are many, particularly at the present time, who are looking for recipes for design—some mathematical formulæ which shall take

the place of creative impulse—and such as these coming across the "Grammar of Design" may hail it as the royal road out of all their difficulties. This can never be. A man may have a perfect knowledge of English grammar, but yet be unable to write ten lines of original or helpful matter. Instinct, impulse and emotion (words which Mr. Edwards as a philosopher rather distrusts) are as real a part of humanity as intellect and reason. Reason at best can only be expressed in language, and language is too clumsy a vehicle to express all the aspirations and needs of mankind. Music, painting, sculpture and architecture all have a direct appeal, the whole of which cannot be put into words. This is why a man may be a great artist but a poor critic; or a great critic and no artist. It is when we come to communicate our ideas on art that we must employ the intellect and the reason, and it is in insisting on this that the writer of this book is especially helpful.

The third part of the book deals with the relations of the artist and various of his fellow men—the statesman, the engineer, the mathematician, the psychologist, the biologist, the historian, the moralist and the metaphysician. This portion of the book is not only very readable, but it is full of wisdom and good sense, much of which the artist would do well to think over and take to heart. This is what Mr. Edwards says in his chapter on "The Artist in Society":—

He is obliged to bear in mind that there are many absorbing occupations besides that of art, and men of powerful will are engaged in them, ambitious men, so anxious to extend their sway that they pay little heed to those who would assert a standard of values different from their own.

The artist, if he is to make a place for himself in the world, must not only be able successfully to contend with these his principal rivals, but he must also win the favour of the general public, the great mass of people who, although not leaders of opinion, are nevertheless the chief dispensers of patronage.

And he is to win this favour, not by tricks and cajolery, but by a firm insistence on principles. Convinced of his own importance to Society, he is to so comport and express himself that others shall be convinced also—a doctrine the good sense of which is obvious.

In "The Artist and Statesman," the question of nationality and design is dealt with in a singularly broad-minded and informing manner.

Dealing with "The Artist and the Engineer," Mr. Edwards has much to say that is extremely controversial. The school of thought which insists on the beauty of construction, pure and unadorned, will not be altogether pleased with the following: "That it is necessary to restrict his (the engineer's) influence will be obvious to many, since the opinion is widely held that mere construction does not suffice, and there is something ungracious about the work of an engineer, if it be not transformed into art."

Dealing with "The Artist and the Biologist," the author treats at length on the origin and definition of instinct, and the relating of it to reason. In reading this section of the book, one is tempted to quote and

to quote again; each one of its chapters could reasonably form the subject of a separate review. One particularly arresting sentence occurs in "Artist and Historian," this is: "The punishment which befalls those who cut themselves off from the past is that they can never be really modern, they can never make new conquests for the human spirit."

This defence of the traditional or historic method of approaching design is so convincing that its truth at once becomes apparent. There are buildings which have endured for ages, which still have about them the bloom of perennial youth; whilst obversely there are others erected but a few years, or it may be days, that look jaded and tired.

Although dealing with all the visible arts, the author, as is natural with an architect, has, perhaps, more to say about architecture than any of (to use his own words) the minor arts, and his brother architects will find in the pages of this book much that has for them a vital and peculiar significance. Throughout the appeal is to the reason and the intellect; and there is almost a passionate plea for the intellectual appreciation of beauty.

One cannot do better than to close this short and quite inadequate review with a further quotation from the author's own chapter entitled "Conclusion":—

And what of the doctrine that intellect has little to do with either the creation or the appreciation of beauty? History denies it. The arts have best flourished in periods when the reason was most active, and every artistic renaissance has been heralded by an intellectual renaissance. Those who would try to bring about an estrangement between intellect and beauty do an ill-service to the arts. If intellect is arraigned and made to suffer injury, then beauty will languish too, for intellect and beauty walk hand in hand.

STANLEY C. RAMSEY [F.]

THE LIBRARY.

Notes by Members of the Literature Committee on Recent Acquisitions.

[These notes are published without prejudice to a further and more detailed criticism.]

THE BUILDER'S JEWEL, or the Youth's Instructor and Workman's Remembrancer. By Batty and Thomas Langley.

THE TREASURY OF DESIGNS, or the Art of Drawing and Working the Ornamental Parts of Architecture. By Batty Langley. [John Tiranti and Co., Maple Street, Tottenham Court Road.]

Two small volumes of reproductions, to a much reduced scale, of the illustrations in the 1741 and 1750 editions, of which the Library possesses copies. The *Treasury of Designs*, besides Palladio's Orders (the treatise on which is not republished here), has an interesting series of mantel-pieces and the like, designed by Batty Langley, a capable craftsman of his time, and well engraved by his brother Thomas. Both the Langleys were well-known teachers, and the Library collection includes several of their educational works, including the somewhat amusing work on the Five Orders of Gothic Architecture. C. H. T.

THE HANDBOOK OF ARCHITECTURAL PRACTICE. 40, Washington. 31s. 6d. [American Institute of Architects, The Octagon House, Washington, D.C.]

A work issued by the American Institute of Architects and "intended as an aid to proper practice and efficient business administration." The earlier part deals with the relations between the architect and client, the methodical administration of the office, the letting of the contract, and the execution and supervision of the work. Its general counsel and its advice as to system are wise and reasonable, though put forward in such detail that the prefatory remarks by the authors themselves suggest that it is not likely that all the steps described in the book will be followed by a practising architect. The latter part contains among the Appendices a "Circular of Advice," dealing with professional conduct and canons of ethics, covering very much the same ground as the statement as to "Professional Conduct and Practice" recently put forward by the Council, and printed in the *Kalendar* this year for the first time. C. H. T.

LES GRANDS TRAVAUX DE LA VILLE DE LYON.

Par Tony Garnier, ancien pensionnaire de l'Académie de France à Rome. Fo, Paris. [Ch. Massin.]

"Enough of Renaissance façades or pavilions in a pseudo Louis XIV style! . . . The Parthenon is in itself admirable, but a modern copy of the Parthenon is merely absurd. An Exchange built like a temple is nonsense. . . . M. Tony Garnier has shown by his examples that architecture should be the expression of its country and its time." A short preface by the Maire, from which these words are taken, introduces M. Tony Garnier's brilliant set of designs for the remodelling of Lyons. M. Garnier is already known to us by his restoration of Tusculum. In these designs for Lyons he has interpreted the lessons of antiquity in their widest sense. Hospitals, schools, abattoirs, and industrial housing schemes are conceived in a monumental but simple manner. His architecture is the outcome of modern materials and a definite expression of the technical requirements of each building. Effect is obtained by simple lines and judicious arrangement of masses. Each of the 56 plates is intensely interesting. The design for La Bourse du Travail, with its flat roofs, square-headed windows and complete absence of columns, pediments, and cornices, is impressive as direct and simple building. Here are no schemes calculated to waste imaginary war indemnities. It is a valuable contribution to the solution of the problem of present-day architecture. H. C. B.

CHRONICLES OF THE CITY OF PERUGIA, 1492 1503.

Written by Francesco Matarazzo. Translated by E. S. Morgan. 80, Lond. 1905. 3s. 6d. [J. M. Dent.]

This fascinating chronicle is an invaluable book to any student who wishes to understand the life and times of the Renaissance period in Italy. It is comparable with Benvenuto Cellini's autobiography, and though it does not directly deal with architecture it is an illuminating commentary on the conditions under which the great artists lived. It approximately covers the period of the Papacy of Alexander VI, the Borgia pope. J. H. W.

THE ARTS IN EARLY ENGLAND. By G. Baldwin Brown, M.A., Professor of Fine Art, University of Edinburgh. 80, Lond. 1921. 30s. net. [John Murray.]

This book—one of a series—deals with Early Saxon remains, chiefly from Northumbria, of which it gives a most scholarly and complete account, with a valuable guide to the deciphering of the runes. C. E. S.

THE LAW AND PRACTICE WITH REGARD TO HOUSING IN ENGLAND AND WALES. By Sir Kingsley Wood, M.P. 80, Lond. 42s. net. [Henry Frowde, Oxford University Press.]

A comprehensive collection of the Acts of Parliament and other documents dealing with housing, with chapters on the powers and duties of local authorities, county councils, public utility societies, etc. The late Minister of Health contributes a preface in which he heartily recommends the book.

A. H. M.

MODERN PRACTICAL JOINERY. By George Ellis. 4th ed. La. 80, Lond. 1920. 45s. [B. T. Batsford, Ltd., 94, High Holborn, W.C.]

This useful book has been considerably enlarged and revised, especially with relation to machine-made joinery, shop fittings, and domestic fitments. There is also an increased amount of information on woods, and a selection has been made of those most suitable for joinery purposes.

J. A. S.

PARTICOLARI DI ARCHITETTURA CLASSICA. Fo, Turin. £3 3s. [C. Crudo & C., via S. Francesco de Paola 11, Turin.]

This volume contains 91 plates of clearly reproduced measured drawings, from various sources, of architectural features—principally doors and windows—typical of the various styles that succeeded one another in Italy from the first to the eighteenth century, prefaced by a few Greek examples.

W. H. W.

Note by a Member of the Science Committee.

HANDBOOK OF BUILDING CONSTRUCTION: Data for Architects, Designing and Constructing Engineers and Contractors. Compiled by a Staff of 46 Specialists. George A. Hool, Professor of Constructional Engineering, Wisconsin University, and Nathan C. Johnson. 2 vols., la. 80, New York, 1920. £3 net. [McGraw Hill Book Co., New York and London.]

This work, which is a new one, has been prepared under the direction of two editors by a staff of forty-six assistant editors, each dealing with a separate branch of the subject. The aim proposed, as stated in the Preface, is "to provide . . . a reference work covering thoroughly the design and construction of the principal kinds and types of modern building with their mechanical and electrical equipment." The two volumes contain, besides the Table of Contents and Index, 1,444 pages of closely printed letterpress freely interspersed with tabular matter, diagrams and illustrations. In addition to a very comprehensive treatment of all that usually comes within the scope of works on building construction, building materials and structural theory, distinct sections are devoted to estimating, contracts, specifications, heating, ventilation, water supply, sewage disposal, electrical equipment and lighting, gas, lifts, refrigeration, vacuum cleaning, house telephones, lightning protection and acoustics. The sections of a more theoretical character, consisting of as thorough a treatment of the subjects in hand as would be suitable in a work of this kind, should be of value to all who are called on to deal with building design; but in some sections, such as those dealing with practical constructional methods and even to some extent in the sections on materials, what is perhaps specially noticeable is the difference that exists between American conditions and practice and what is usual in this country. These volumes have been compiled primarily for American constructors. To serve an equally useful purpose

on this side of the Atlantic a good deal—except, as already stated, the more theoretical sections—would need to be considerably modified; but, on the other hand, constructors in any country do well to study foreign methods. There is always profit to be derived from considering the *modus operandi* of fellow craftsmen working on similar problems to our own but under different conditions.

JOHN H. MARKHAM [A.].

CORRESPONDENCE.

"Decently and in Order."

To the Editor, JOURNAL R.I.B.A.,—

SIR,—Will you allow me to ventilate the subject of Special Committees appointed from time to time by the Council? The advent of these committees is generally made sufficiently known, but as far as my experience goes their demise is often shrouded in mystery likely to produce most erroneous impressions on members, and what is more important, on outside organisations. May I venture to cite two instances in the hope that it will be made clear by others that these are quite exceptional?

Some years ago now the Institute was approached from outside as to a standard specification for timber to assist contractors in fair estimating. The Council appointed a committee which met the Timber Trades Federation and the Master Builders at Conduit Street when I was rash enough to promise further conferences after the R.I.B.A. had considered the matter. This committee, after a good deal of work, presented a specification to the Council which was referred back, and as the committee did not feel able to alter its report, it formally resigned, and its resignation was accepted though its existence continued to be recorded in the *Kalendar* for some time. As far as I know no new committee was appointed nor were the outside bodies ever communicated with—the matter simply dropped into oblivion.

More recently a Research Committee (of Council)—the outcome of matters initiated by the Science Committee—was appointed, which got into touch with several important outside institutions and departments and pressed the need for building research in useful directions. Then, with a very proper wish to reduce committees, it was intimated that this work should be done by the Science Committee. This, of course, sacrificed the principle of continuity which, however, the Institute never seems to take as seriously as other corporate bodies. This Research Committee has never been formally wound up or asked for any report. Meantime one of its activities has matured, and with the very material help of, and in conjunction with, outside bodies, it now has a research—entirely the outcome of its own initiative—actually in progress on the corrosion of metal fittings used in the building industry, which is being carried on by a trained scientist at a cost of some £800 a year, which the Council has condoned by a contribution of £10, one of the members of the defunct committee being chairman of the com-

mittee controlling this research. It can now only report to the Science Committee, but as its members are not all members of this committee the position is very unsatisfactory and unbusinesslike. To anyone not in close touch with Conduit Street the impression is probably conveyed that a paper Research Committee was appointed which did nothing and was then privately buried. Surely every committee no longer wanted should be formally wound up and its report and the reasons for its demise should be printed in your JOURNAL, as much for the benefit of the Institute as for members individually, and I should value the opinions of your correspondents on the desirability of moving some resolution on the matter at one of our Business Meetings.—Yours, etc.,

ALAN E. MUNBY [F.].

Common Sense in Building Construction.

18th April 1921.

To the Editor, JOURNAL R.I.B.A.,—

SIR,—The practical points which have been raised in this correspondence have not been without interest; nor, perhaps, without value. But before it is closed I should like to give the particulars which Mr. Robertson quite rightly demands of the basis upon which the scantling of the floor beams shown was determined. This will necessarily leave some minor points unanswered, which is unavoidable; the only reason for a further and, I hope, a last, intrusion on your space being the fact that the possibilities of very large aggregate economies would otherwise be left in doubt after severe criticism.

Possibly, also, it may serve to convince your correspondent who, on page 295 of the JOURNAL, refers to the Ministry of Health that the methods of calculation adopted are not only "in connection with recognised formulæ," but also in strict logical accordance with the Ministry's own regulations.

He will, I am assured, agree after further consideration that the Ministry's stipulation that alternative scantlings must be of equal area to those specified inevitably prevents any possible economies on individual joists, and might be altered with advantage to a stipulation of equal strength or equal stiffness.

Recognised formulæ for beams may shortly be summarised as rules whereby the working load is limited to that which will not stress the fibres beyond a certain limit, generally 1,000 lb., or about 9 cwt. per square inch, or cause a deflection of more than 1-500th of the span. One has a shrewd suspicion that the fibre stress has been limited by considerations of stiffness rather than those of safety. In America, where timber is comparatively plentiful, and is generally used somewhat liberally, the usual limit is about 1,500 lb. for fibre stress; whilst the deflection which is assumed to be dangerous to plaster ceilings is commonly specified in American text-books at 1-250th of the span.

Obviously, before any formula can be applied to a floor beam it is necessary to specify a reasonable average floor loading. The designer has three courses open

to him. He can (a) adopt the L.C.C. figure of 70 lb. per square foot (practically the $\frac{3}{4}$ cwt. recommended by Mr. Schneider in America in 1904), which, of course, covers all domestic floors including those of large rooms in which dances or sales could reasonably be expected. (b) He can ascertain the actual loading in typical small cottage bedrooms, reasonably well crowded; which will give a figure of about 15 to 20 lb., or he can (c) deduce the loading with which the Ministry of Health scantlings of individual floor joists are consistent.

The last-named course, being found to be reasonably consistent with (b), was adopted for the beams shown.

It is, of course, impossible to make an exact deduction from any schedule. It may be based upon either stiffness or strength, and the practical market sizes specified cannot agree exactly with theoretical requirements.

Fortunately, however, the limit of deflection of 1-40th inch per foot of span or span \div 500 is so generally accepted in this country as to be practically stereotyped; and the average value of the elastic modulus of fir is equally well established at about 1,600,000 lb. per square inch. When, therefore, it is found that each of the scantlings specified is the market size next above that which would produce this deflection under a load of 56 lb. per foot super, and that under that loading the stress on 2-inch joists is necessarily 817 lb. per square inch, it is obvious that this must be taken as the limit loading for the Ministry's joist scantlings.

But individual joists are liable to concentrated loads, shocks, etc., and these are equivalent to more than double the average loading over the whole floor, which is that which main beams are called upon to carry.

An average total loading of 28 lb. per foot super. over the whole floor is therefore clearly consistent with the Ministry code, and after allowing for the weight of floor joists, flooring and ceilings, this appears to represent very fairly the super. load on the floor of an ordinary bedroom rather crowded with heavy furniture.

Without troubling your readers with mathematics, it can be shown that the moment of inertia $\left(\frac{bd^3}{12}\right)$ re-

quired to keep within a limiting deflection of $\frac{\text{span}}{500}$ is

$BS^3 \div 60$ when B = the breadth in feet of floor carried and S = span in feet or $bd^3 = BS^3 \div 5$.

In cases where the total cube of timber used is reduced by the use of main beams and the usual plaster ceiling (some 6 or 7 lb. per square foot) is also omitted, it would be consistent still further to reduce the loading; but this was not done in the floors shown.

Taking the criticised main beam in Fig. 2, page 193 of the JOURNAL of February 5th, the span measured to the edge of bearings over which it will deflect, and not as in steelwork on flexible cleats to the centre of bearings, is 10 feet 6 inches. The breadth (B) of floor

carried is 7.5 feet, and the distributed load is therefore $10.5 \times 7.5 \times \frac{1}{4}$, say 20 cwt. At 9 cwt. per square inch the safe load would be $\frac{bd^2}{8}$ or 23 cwt. Actually, test beams of the same scantling, of thoroughly bad timber, and 18 inches longer span failed under a distributed load of 112 cwt.

The moment of inertia of a 5 x 7 section is 142.9 or $bd^3 = 1,715$. The deflection = $\frac{5}{384} \times \frac{2,240 \times 126^3}{142.9 \times 1,600,000} = .26$ inch, or almost exactly span $\div 500$.

It is a very simple matter to tabulate, with the above short formula, the scantlings required for given spans or breadths of floor carried. If it be considered expedient to vary the loading of 28 lb., all that is necessary is to vary the divisor accordingly. Thus, for an average floor load of 56 lb. the formula becomes $bd^3 = BS^3 \div 2.5$, whilst divisors of 2 and 3 represent 70 and 45 lb. per square foot respectively.

If the economy of beamed floor construction is striking, no less so is its charm, which can readily be appreciated from the illustration to Sir Lawrence Weaver's paper on page 316 of the JOURNAL.

Is it too much to ask that the Ministry of Health, by a leaflet instruction, should authorise definite loadings and formulæ either for stiffness or strength, to which main beams should be designed.

This long correspondence has at least shown how wide a divergence of opinion is possible.—Yours, etc.,
PERCY J. WALDRAM, *Licentiate*.

COMPETITIONS.

Renfrew War Memorial.

Members and Licentiates must not take part in the above Competition because the Conditions are not in accordance with the published Regulations of the R.I.B.A. for Architectural Competitions.

Salisbury, Rothesay, Queensbury, Wick and Hagley War Memorials.

The Competitions Committee desire to call the attention of Members and Licentiates to the fact that the Conditions of the above Competitions are unsatisfactory. The Committee are in negotiation with the promoters in the hope of securing an amendment, and in the meantime Members and Licentiates are advised to take no part in the Competitions.

COMPETITIONS OPEN.

Qasr el 'Aini Hospital and School, Cairo.

Bengal Council Chamber.

Canadian Battlefields Memorials.

Chauny (Aisne), France : Drainage and Water Supply : Inter-Allied Competition.

The conditions and other documents relating to the above Competitions may be consulted in the Library.



9 CONDUIT STREET, REGENT STREET, W., 7th May 1921.

CHRONICLE.

The Prince of Wales [Hon. F.].

At the Annual General Meeting on Monday, 2nd May, His Royal Highness the Prince of Wales was elected by acclamation *Honorary Fellow R.I.B.A.*

Postponement of the Annual Dinner.

In consequence of the industrial situation it has been necessary to postpone the Annual Dinner of the Institute and the Conference of the Franco-British Union of Architects until a date which will be announced later.

R.I.B.A. Public Lectures on Architecture.

The lectures hitherto delivered of the series initiated and arranged by the Literature Committee with the object of arousing a wider interest in architecture have been a marked success, both in the quality of the lectures and in the character of the audiences which have assembled to hear them. It may be claimed for the lectures already that they are justified by the result. The audiences have consisted very largely of members of the outside public of the class the Committee are especially anxious to attract. At Mr. Clutton Brock's lecture on April 28th, the Great Gallery was filled to overflowing, every seat and all available standing-room being occupied. His address, to which he had given the attractive title "Architecture as Everyone's Concern," was enlivened throughout with touches of humour which greatly charmed and delighted the assembly, and he held their interested attention every moment of the hour he was speaking. The President, Mr. John W. Simpson, who presided, pronounced it to be one of the most important and one of the most living discourses he had ever heard at the Institute. The lecturer, he said, summed up the whole gospel and marrow of the art of architecture in his insistence on the fact that architecture was "good building." Mr. Clutton Brock spoke only from notes, but a shorthand note was taken of his address, and it will be published with the others of the series at an early date.

Mr. F. C. Eden had an equally appreciative audience for his extremely interesting lecture, "Architecture and Travel," delivered on the 5th inst. Sir Aston Webb, P.R.A., presided, and again every seat was occupied. Mr. Eden warned his hearers that if archi-

ture is to be rationally enjoyed, they must be on their guard against much of the misleading criticism which was assumed by the text-books as axiomatic. He exhorted them to beware of books which laid down general laws or principles to which Architecture must conform under penalty of becoming "insincere," "imitative," or what not. The only principles he knew of were the three enumerated by the seventeenth century scholar, Sir Henry Wotton, and they covered the whole ground. "Well-building," he wrote, "hath three conditions: Commodity, Firmness, and Delight." The building must conform to practical requirements—that is what he means by "Commodity." It must obey mechanical laws—that is "Firmness." The third is the condition which makes architecture an art; it must satisfy man's love of beauty—that is "Delight." It is this quality of giving delight that we seek when on our travels and are free to treat architecture as a pastime. Touching upon the picturesque in architecture, the lecturer brought out that it did not arise from a jumble of incompatible elements, still less from ruin and decay. Looking down from the top of a tower on any old town that has escaped the heavy hand of modernism, the most striking element in the picture is the unity of the roofs—unity of pitch, unity of material, unity of colour. A slate or a galvanised-iron roof strikes a jarring note; still more so does a ruined roof, with the tiles fallen in and the skeleton showing. Dilapidation is never picturesque. As an object-lesson in town-planning, the lecturer showed lantern slides of some charming old Italian piazzas, casual and irregular looking, but which, by the comparison of two or three examples, disclosed some common principle of arrangement, pointing to the conclusion that accident had not contributed so largely to their attractiveness as appeared at first sight. Finally, by means of the lantern, the audience were taken a short architectural tour through a part of Italy which the lecturer said was not remarkable for any great contribution to the arts, but where could be seen the sort of thing any traveller in Italian by-ways might come across—just, in fact, what Italy of her careless abundance spills as it were by the roadside. After a visit to Pesio, the party were taken a turn up the Valley of the Dora, to the west of Turin as far as the Sagra di San Michele; then in a north-easterly direction to Biella, at the foot of the Pennines, to visit a group of sanctuaries, Oropa, and the Sacro Monte of Varallo, Orta and Varese, finishing at the Lakes.

R.I.B.A. Prizes and Studentships, 1921-1922.

The ESSAY SILVER MEDAL and £26 5s. open to British subjects under the age of forty, will be awarded for the best Essay on a subject of architectural interest, the choice of which is left to the competitor. Competitors are expected to make a useful contribution to knowledge by accurate research so that the Essays may be accepted as authoritative statements on the subjects dealt with. Candidates in the Final Examination competing for this Prize may submit their Essay as the Thesis required under the Revised Syllabus.

The SOANE MEDALLION AND £150 (Travelling Studentship) open to British subjects under the age of thirty, for the best Design for a Central Group of Buildings for a modern non-residential University, comprising Convocation Hall, Senate and Faculty Rooms, Robing Rooms, and a Lecture Theatre. The building to be conceived as the centre of a group of university buildings which accommodate 6 Faculties.

The PUGIN TRAVELLING STUDENTSHIP—SILVER MEDAL and £75—for the study of the Mediæval Architecture of Great Britain and Ireland, open to architects of any country between the ages of eighteen and twenty-five, who submit the best selection of drawings and testimonials.

The OWEN JONES TRAVELLING STUDENTSHIP, value £100, open to architects under the age of thirty-five. Competitors must submit testimonials, with drawings, some of which must be from existing buildings and from other examples, exhibiting their acquaintance with colour decoration and with the leading subjects treated of in Owen Jones's *Grammar of Ornament*, together with an architectural design treated in colour decoration.

The HENRY SAXON SNELL PRIZE, value £50, open to architects (who may associate with themselves members of the medical profession), for the best Design for an Asylum for 200 Aged and Infirm Poor.

The HENRY JARVIS TRAVELLING STUDENTSHIP, value £250 a year, tenable for two years at the new British School at Rome. Candidates must be under the age of thirty, and either Associates or registered Students of the Institute.

The GRISSELL PRIZE for DESIGN and CONSTRUCTION, consisting of a Gold Medal and £50, open to British subjects who have not been in professional practice more than ten years, will be awarded for the best Design for a Mooring Mast for an Airship in connection with an hotel accommodating 50 passengers.

The ARTHUR CATES PRIZE, value £30, open to students who have passed the R.I.B.A. Final Examination, and awarded for the best set of drawings comprising studies of subjects of Classical or Renaissance and Mediæval Architecture, and also detailed studies in relation to the application of geometry to vaulting and stability of edifice.

The ASHPITEL PRIZE (£10 in books), awarded to the Student who has the most highly distinguished himself in the Final Examination of the year.

The following Prizes and Studentships will be offered in the Competitions for 1922-23:—

The TITE PRIZE—Certificate and £100.

The GODWIN BURSARY and WIMPERIS BEQUEST—Silver Medal and £130.

The R.I.B.A. SILVER MEDAL and £50 for MEASURED DRAWINGS.

The Pamphlet containing full particulars of the Prizes and Studentships, together with the Conditions of Competition and Award and General Advice to Architectural Students, may be obtained at the Office of the Institute, price 6d., by post 8d.

**Notes from the Minutes of the Council Meeting,
2nd May 1921.**

Unification and Registration.—At a special meeting the Council considered the Report of the Unification Sub-Committee and advised the representatives of the Royal Institute in view of the meeting of the Unification Committee on 12th May.

The Office of Works.—The Council approved a recommendation from the R.I.B.A. Office of Works Committee that a deputation should be sent to the First Commissioner of Works.

The Scale of Fees for Housing Schemes.—It was reported that the Director-General of Housing, Sir Charles Ruthen, had consented to receive a deputation to discuss all outstanding questions connected with the scale of fees for housing schemes.

The Ken Wood Preservation Council.—The President was appointed to represent the Royal Institute on the Ken Wood Preservation Council.

The Honorary Associateship.—The Council directed the Secretary to summon a Special General Meeting to consider the proposed alterations in the by-laws affecting Honorary Associates.

Rapid Testing of Steel and other Metals.—The Council approved a recommendation of the Science Standing Committee that a demonstration should be made at a General Meeting of the Royal Institute of a new machine for rapidly testing steel and other metals.

Appointment of Examiners.—On the recommendation of the Board of Architectural Education the Council appointed the examiners for the June examinations.

The Annual Dinner and Conference of the Franco-British Union of Architects.—In view of the industrial situation it was decided to leave in the hands of the President the question of postponing the Annual Dinner and the Conference of the Franco-British Union of Architects.

Grants to Private Builders.

The following memorandum, dated 28th April, has been issued by the Ministry of Health :—

In General Housing Memorandum No. 41 which was issued in December last, local authorities were notified that in consequence of the rejection of the Ministry of Health (Miscellaneous Provisions) Bill, it would not be possible under the existing law to pay the full amount of the subsidy under the Subsidy to Private Builders Scheme in respect of houses completed during the early months of 1921, and that it would be necessary for local authorities to discontinue the issue of Certificate A as from 23rd December. An undertaking was, however, given on behalf of the Government that legislation would be introduced at the beginning of the present session of Parliament to provide for payments in full to those completing houses between 23rd December 1920 and the date of the coming into operation of the new Act, and to extend the period during which the subsidy can be earned. In accordance with this undertaking the Government have introduced a Bill for the purposes above mentioned, and it is hoped that this Bill will

become law at an early date. In the meantime local authorities will, of course, have no authority to issue Certificate B in respect of houses completed after 23rd April 1921. Local authorities should, however, examine any applications which are made for the issue of Certificate B, and if they are in order should inform the applicant accordingly, and that Certificate B will be issued as soon as Parliament has granted the necessary powers.

The Building Exhibition, Olympia.

The President, Mr. JOHN W. SIMPSON, presided at the dinner given by the Architects' Welcome Club at the Building Exhibition, Olympia, on the 22nd inst. Proposing the toast of "The Building Exhibition," he congratulated Mr. Greville Montgomery on the great success of this year's Exhibition; the best, he thought, which had been held since the exhibitions were started some twenty-five years ago. Referring to the visit of the King and Queen,* he said that, despite the trying times, despite mischievous and dangerous propaganda in certain parts, the people of the country remained steadily loyal to the Crown. It could hardly be said that the prosperity of the building industry had been restored, but it showed clear signs of recovery. There was a better output by the operatives, and that better output was at once reflected in lower prices. Architects, surveyors, builders, and operatives were naturally anxious to do their best for the building industry, since they were all affected by its prosperity and all lived by it. But their efforts at reviving the industry could be of little use whilst the east wind of high costs prevailed and withered the good intentions of the building owner. It was curious that those who promoted strikes did not recognise their inevitable futility; a strike was a weapon that injured first and foremost those who used it by creating unemployment. Amongst the means of improving the building industry he placed the Building Exhibition very high for two reasons: (1) the general public was extremely interested in building, building materials, and the processes of building, and the Exhibition fostered and encouraged that healthy interest; (2) because publicity was essential to commerce, and there was no publicity equal to that afforded by a well-organised exhibition. The gathering that evening comprised many architects from different camps, and would hardly have been possible two years ago. It was an excellent augury for the unity of the great profession that many had at heart. He congratulated his fellow President, Sir Charles Ruthen, and the country also, on his appointment as Director of Housing. That appointment would be fruitful of the most beneficial results not only to architects but also to the taxpayers.

Mr. H. GREVILLE MONTGOMERY, in responding, said the ready response made by the King to the invitation to visit the Exhibition showed a fine business capacity that many architects might emulate with advantage. It would be a good idea if the Architectural Association were to incorporate business training in its curriculum. He was very glad to think the Exhibition had done something to help to bring about the unification of the profession that was so desirable.

Sir CHARLES RUTHEN [F.], President of the Society of Architects, proposing "The Guests," said he saw no reason

* His Majesty, accompanied by the Queen, the Duke of York, Princess Mary and Prince Henry, made the tour of the Exhibition under the guidance of the President. The Royal party spent over two hours going the round of the stands and were greatly interested in the exhibits.

why architects who followed Mr. Simpson and himself should not work harmoniously together, as he and Mr. Simpson had done. They had both done their best for the profession, and if success did not immediately follow it would not be the fault of the Presidents of the Institute and the Society. If the country had fully realised the importance of the building industry to industrial development in the years gone by he believed much of the present industrial unrest would not have come about. If the people had reasonable conditions of living, not only would they be better craftsmen but they would also give a better output. It was very unfortunate, and typically British, that one of the greatest social problems—housing—had been left to come up for solution immediately after one of the greatest upheavals the world had ever seen. But he believed the difficulties would be surmounted, as the country had surmounted big difficulties in the past, and eventually the working classes would once more be happy and comfortable. Architects, quantity surveyors, builders, and concrete engineers should all work harmoniously together in order to get the building industry into a thoroughly satisfactory condition.

Mr. A. J. FORSDIKE, President of the National Federation of Building Trades Employers, who responded, said those present that evening represented a very powerful combination, covering as they did every branch of the building industry, and with such a combination working together in harmony anything might be accomplished. A great change had come about in the building industry during the past few years, and those who carried out the actual building operations were now able to get into closer touch with architects and quantity surveyors than ever before. The building employers of the country felt much indebted to the architects for the steps they had taken in that direction, and were quite as anxious as they for closer co-operation. The best results could only be obtained by the close relationship of all concerned.

Mr. J. W. LORDEN, M.P., in proposing the health of the Chairman, said in his opinion modern architects were doing work as good in every respect as the architects of the past, and perhaps even better, but they were considerably handicapped by the high cost of building. The time had come when architects, builders, and operatives must pull together.*

The Annual Elections : New Nominations to Council and Committees.

The following nominations have been made by members in accordance with By-law 33:—

As Vice-President.

DOWNING : HENRY PHILIP BURKE, F.S.A. [F.]. Nominated by Wm. A. Pite, Sydney Tatchell, Alan E. Munby, Leslie T. Moore, Edward Maufe, Alner W. Hall, Austin Durst, W. Howard Seth-Smith, T. P. Figgis, *Fellows*; A. Needham Wilson, Robt. W. Pite, *Associates*.

HUBBARD : GEORGE, F.S.A. [F.]. Nominated by Alfred W. S. Cross, Wm. Woodward, W. Gillbee Scott, Herbert A. Satchell, Max Clarke, *Fellows*; Chas. A. Daubney, K. Gammell, *Associates*.

SEARLES-WOOD : HERBERT DUNCAN [F.]. Nominated by Delissa Joseph, William A. Pite, Sir Henry Tanner, Lewis Solomon, A. H. Kersey, Ernest Flint, Percival M. Fraser, *Fellows*.

As Members of Council.

FYFE : THEODORE [F.]. Nominated by H. Austen Hall, James S. Gibson, W. B. Simpson, W. S. A. Gordon, W. Curtis Green, *Fellows*; Herbert Passmore, H. C. Brown, *Associates*.

GILL : CHARLES LOVETT [F.]. Nominated by A. E. Richardson, Stanley C. Ramsey, S. D. Adshead, Arthur Stratton, Martin S. Briggs, *Fellows*; E. B. Musman, W. Harding Thompson, *Associates*.

JOSEPH : DELISSA [F.]. Nominated by H. D. Searles-Wood, Walter J. Burrows, F. T. W. Goldsmith, F. Adams Smith, Henry T. Gordon, R. M. Roe, *Fellows*; Chas. A. Daubney, *Associate*.

MUNBY : ALAN EDWARD, M.A. Cantab. [F.]. Nominated by W. A. Pite, T. P. Figgis, R. Unwin, H. D. Searles-Wood, George Hubbard, Herbert W. Wills, *Fellows*; A. Needham Wilson, *Associate*.

SCOTT : WILLIAM GILLBEE [F.]. Nominated by W. Henry White, Herbert A. Satchell, Wm. G. Hunt, Alfred W. S. Cross, Wm. Woodward, *Fellows*; Horace Cubitt, K. Gammell, *Associates*.

WILLS : HERBERT WINKLER [F.]. Nominated by Alfred W. S. Cross, George Hubbard, S. D. Adshead, Sydney Tatchell, *Fellows*; Patrick Abercrombie, Horace Cubitt, Herbert A. Welch, *Associates*.

As Associate Members of Council.

BUCKNELL : LEONARD HOLCOMBE [A.]. Nominated by H. Austen Hall, Robt. Atkinson, E. Stanley Hall, Ernest Newton, *Fellows*; William G. Newton, G. D. Gordon Hake, W. T. W. Ching, *Associates*.

BUDDEN : LIONEL BAILEY, M.A. [A.]. Nominated by Alfred W. S. Cross, George Hubbard, S. D. Adshead, James S. Gibson, Sydney Perks, *Fellows*; Patrick Abercrombie, Horace Cubitt, *Associates*.

HAKE : GUY DONNE GORDON [A.]. Nominated by H. Austen Hall, Hugh P. G. Maule, W. H. Ward, Robt. Atkinson, *Fellows*; L. H. Bucknell, R. A. Duncan, C. H. James, *Associates*.

SHEPPARD : ARTHUR WILLIAM [A.]. Nominated by G. Topham Forrest, Maurice E. Webb, W. E. Riley, Fredk. R. Hiorns, *Fellows*; E. P. Wheeler, Chas. McLachlan, W. T. Curtis, *Associates*.

As Member of the Art Committee.

ADSHEAD : PROFESSOR STANLEY DAVENPORT, M.A. [F.]. Nominated by Stanley C. Ramsey, Professor A. E. Richardson, Arthur Stratton, C. Lovett Gill, D. Barclay Niven, *Fellows*; W. Harding Thompson, E. B. Musman, *Associates*.

As Member of the Literature Committee.

STRATTON : ARTHUR, F.S.A. [F.]. Nominated by W. H. Ward, Theodore Fyfe, Martin S. Briggs, H. Austen Hall, H. H. Statham, Louis Ambler, *Fellows*; J. Alan Slater, *Associate*.

As Associate Member of the Literature Committee.

ANSELL : WILLIAM HENRY, M.C. [A.]. Nominated by Theodore Fyfe, W. H. Ward, Martin S. Briggs, H. Austen Hall, Matthew Dawson, Ernest Newton, Maxwell Ayrton, F. W. Troup, Winton Newman, Henry V. Ashley, *Fellows*.

BIRNSTINGL : HARRY JOSEPH [A.]. Nominated by Frank M. Elgood, Guy Church, Stanley C. Ramsey, Fredk. Chatterton, R. Allsebrook Hinds, *Fellows*; Ralph W. Thorp, J. H. Belfrage, *Associates*.

As Members of the Practice Committee.

COLLARD : ALLAN OVENDEN [F.]. Nominated by Sir Banister Fletcher, Ernest S. Gale, Alex. P. Durlacher, George A. Lansdown, C. H. B. Quennell, *Fellows*; Bernard W. H. Scott, Wm. E. A. Brown, *Associates*.

LOVEGROVE : GILBERT HENRY [F.]. Nominated by R. Elsey Smith, Sydney Perks, Francis J. Sturdy, Arthur F. Usher, *Fellows*; R. H. J. Mayhew, H. McLachlan, Henry Lovegrove, Joseph Hill, *Associates*.

* Our acknowledgments are tendered to *The Builder* for the report of these speeches.

NICHOLAS: CHARLES [F.]. Nominated by J. E. Dixon-Spain, Owen C. Little, Henry J. Chetwood, Basil Oliver, *Fellows*; Eustace Corrie Frere, Ian B. M. Hamilton, Kenneth S. Broad, *Associates*.

As Associate Members of the Practice Committee.

COCKRILL: GILBERT SCOTT [A.]. Nominated by Major Harry Barnes, Sir Henry Tanner, R. J. Williams, R. J. Thomson, Leslie Mansfield, *Fellows*; K. A. Cockrill, C. Wilfrid Box, Alex. G. Bond, *Associates*.

HAMLIN: WILLIAM HENRY [A.]. Nominated by Alfred W. S. Cross, W. Gillbee Scott, Fredk. R. Hiorns, Henry Hyams, *Fellows*; H. V. Milnes Emerson, H. Haylock Golding, K. Gammell, *Associates*.

JELLEY: FREDERICK RICHARD [A.]. Nominated by Alfred W. S. Cross, W. Gillbee Scott, Fredk. R. Hiorns, Henry Hyams, *Fellows*; H. V. Milnes Emerson, H. Haylock Golding, K. Gammell, *Associates*.

Attendances at Council and Standing Committee Meetings, 1920-1921.

COUNCIL (16 meetings).

John W. Simpson, *President*, 15; Walter Cave, *Vice-President*, 7; E. Guy Dawber, *Vice-President*, 14; Prof. S. D. Adshead, *Vice-President*, 10; A. W. S. Cross, *Vice-President*, 13; Sir Reginald Blomfield, *Past-President*, 1; Arthur Keen, *Hon. Secretary*, 16.

Members of Council.—Robert Atkinson, 7; Major Harry Barnes, M.P., 3; Max Clarke, 10; H. P. Burke Downing, 15; Sir Banister Fletcher, 13; H. M. Fletcher, 11; James S. Gibson, 11; W. Curtis Green, 12; E. Stanley Hall, 13; E. Vincent Harris, 10; George Hubbard, 14; H. V. Lanchester, 2; T. Geoffrey Lucas, 8; Sir Edwin Lutyens, 3; Sydney Perks, 15; W. E. Riley, 16; Paul Waterhouse, 10; Maurice E. Webb, 12.

Associate Members of Council.—Prof. Patrick Abercrombie, 2; Horace W. Cubitt, 14; W. G. Newton, 13; Stanley H. Hamp, 9; J. Stockdale Harrison, 4; Digby L. Solomon, 15.

Representatives of Allied Societies.—H. T. Buckland, 8; C. S. Errington, 2; C. B. Flockton, 9; J. Alfred Gotch, 2; A. W. Hennings, 9; Llewellyn Kitchen, 5; T. Taliesin Rees, 7; George Watt, 0; W. B. Whitie, 6.

Representative of Architectural Association.—G. Gilbert Scott, 1.

STANDING COMMITTEES.

Art (6 Meetings).—*Fellows*: Ernest Newton, 0; Walter Cave, 2; H. P. Burke Downing, 2; W. A. Forsyth, 2; J. Alfred Gotch, 1; S. K. Greenslade, 0; J. J. Joass, 2; Prof. F. M. Simpson, 3; Walter Tapper, 5; Maurice E. Webb, 5. *Associates*: W. R. Davidge, 1; H. S. East, 0; J. B. Fulton, 0; Edwin Gunn, 0; L. Rome Guthrie, 0; P. W. Lovell, 5. *Appointed by Council*: Sir Edwin Lutyens, 0; H. V. Lanchester, 0; F. R. Hiorns, 6; J. D. Coleridge, 5; Alfred Cox, 5.

Literature (8 Meetings).—*Fellows*: Louis Ambler, 7; M. S. Briggs, 4; Major H. C. Corlette, 7; E. Guy Dawber, 0; H. M. Fletcher, 6; H. Austen Hall, 3; H. H. Statham, 5; C. Harrison Townsend, 8; W. Henry Ward, 7; P. Leslie Waterhouse, 5. *Associates*: H. Chalton Bradshaw, 3; A. T. Edwards, 4; A. H. Moberly, 8; Herbert Passmore, 1; J. Alan Slater, 8; J. H. Worthington, 2. *Appointed by Council*: D. Theodore Fyfe, 6; C. E. Sayer, 5; T. S. Attlee, 0; Miss Ethel Charles, 6; Major Harry Barnes, M.P., 0.

Practice (11 Meetings).—*Fellows*: H. V. Ashley, 7; Max Clarke, 10; A. W. S. Cross, 9; W. G. Hunt, 10; Sydney Perks, 7; W. Gillbee Scott, 8; John Slater, 4; F. W. Troup, 3; W. Henry White, 7; Wm. Woodward, 8. *Associates*: Horace Cubitt, 11; H. V. M. Emerson, 10; K. Gammell, 7; H. H. Golding, 5; C. E. Hutchinson, 4; Chas. McLachlan, 5. *Appointed by Council*: H. A. Satchell, 9; Delissa Joseph, 7; Arthur Keen, 3; Herbert A. Welch, 9; G. Topham Forrest, 3.

Science (8 Meetings).—*Fellows*: Prof. S. D. Adshead, 1;

J. Ernest Franck, 8; George Hornblower, 0; George Hubbard, 0; Alan E. Munby, 8; Henry A. Saul, 5; H. D. Searles-Wood, 6. *Associates*: C. A. Daubney, 8; P. W. Hubbard, 3; J. N. Markham, 3; Herbert Shepherd, 5; Digby L. Solomon, 2; T. F. Hansford White, 1. *Appointed by Council*: Sir Charles Ruthen, 0; Arthur Ashbridge, 0; R. Stephen Ayling, 1; Felix Clay, 2; Robert Angel, 4; W. E. Riley, 2; Michael Waterhouse, 1; Charles Woodward, 7.

MINUTES. XIII.

At the Annual General Meeting (being the Thirteenth General Meeting of the Session 1920-21) held Monday, 2nd May, 1921, at 8 p.m.—Present: Mr. John W. Simpson, *President*, in the Chair; 31 *Fellows* (including 13 members of the Council) and 28 *Associates* (including 3 members of the Council), the Minutes of the meeting held 18th April, having been published in the *JOURNAL*, were taken as read and signed as correct.

The Hon. Secretary announced the decease of the following members:—Stanislas Louis Bernier, of Paris, *Hon. Corresponding Member*, elected 1912; William Alphonsus Scott, Professor of Architecture in the National University of Ireland, *Associate*, elected 1899; George Lay Crickmay, *Fellow*, elected 1888; John Henry Phillips, of Cardiff, *Fellow*, elected 1904.

On the motion of the Hon. Secretary it was **RESOLVED** that the regrets of the Institute for the loss of these members be recorded on the Minutes of the meeting.

The following *Associates* attending for the first time since their election were formally admitted by the President:—Leslie Owen Ross and Ion Beresford Pite.

The Secretary announced the names of candidates nominated for election.*

The election of HIS ROYAL HIGHNESS THE PRINCE OF WALES as HONORARY FELLOW was carried by acclamation.

The President formally presented the Report of the Council for the official year 1920-21 and briefly reviewed the work of the Institute during that period.

At the request of the President, representatives of the Board of Architectural Education, the four Standing Committees and other Committees whose proceedings are included in the Report addressed the meeting on matters that had engaged their special consideration, Professor Beresford Pite [F.] speaking for the Board of Education, Mr. Walter Tapper [F.] for the Art Committee, Major H. C. Corlette, O.B.E. [F.] for the Literature Committee, Mr. A. W. S. Cross [F.] for the Practice Committee, Mr. Alan E. Munby [F.] for the Science Committee, Mr. W. G. Wilson [F.] for the Competitions Committee, Mr. Sydney Perks [F.] for the Finance Committee, and Mr. W. R. Davidge [A.] for the Town Planning Committee.†

The President having moved the adoption of the Report and invited discussion upon it, the Hon. Secretary seconded the motion, and Mr. Wm. Woodward [F.] briefly reviewed the report and spoke appreciatively of the staff and of the indebtedness of the Institute to the President for his distinguished services to the profession during his tenure of the Chair.

Mr. John Slater [F.] and Mr. Herbert A. Welch [F.] also addressed the meeting.

The motion having been put from the Chair, it was **RESOLVED**, unanimously, that the Report of the Council for the official year 1920-1921 be approved and adopted.

Upon the motion of Mr. Woodward, seconded by Mr. Sydney Perks, a vote of thanks was passed by acclamation to Mr. Harold Goslett [F.] and Mr. C. E. Hutchinson [A.] for their services as Auditors, and Mr. John Hudson [F.]

* The names were published in the *JOURNAL* for 9th April, p. 340, and again in the present issue, with the names of the proposers, on p. 404.

† A brief résumé of their remarks and of the ensuing discussion will appear in the next issue.

and Mr. A. W. Sheppard [A.] were nominated Auditors for the ensuing year of office.

The proceedings closed and the meeting separated at 10 p.m.

Appointment.

The Worshipful Company of Ironmongers have appointed Mr. Sydney Tatchell [F.], of the firm of Messrs. Bourchier, Tatchell and Galsworthy, as their surveyor.

NOTICES.

Business Meeting 6th June 1921.

An election of members will take place at the Business General Meeting, Monday, 6th June. The names and addresses of the candidates (with the names of their proposers), found by the Council to be eligible and qualified for membership according to the Charter and By-laws and recommended by them for election, are as follows:—

AS FELLOWS (6).

BIDLAKE: WILLIAM HENRY, M.A. Cantab. [A. 1888], 37 Waterloo Street, Birmingham, and 72 Pershore Road, Edgbaston, Birmingham. Proposed by E. Guy Dawber, F.S.A., John W. Simpson, C. E. Bateman.

HILL: JOSEPH [A. 1913], 45 Finsbury Pavement, E.C.2, and 21 Surbiton Hill Park, Surbiton, Surrey. Proposed by James S. Gibson, E. Guy Dawber, F.S.A., Francis J. Sturdy.

JOHNSON: GEORGE ALFRED [A. 1905], 2 Siking Road, Shanghai. Proposed by Henry Tanner, Alfred Cox, Louis Ambler.

MILLARD: WALTER JOHN NASH [A. 1885], Dell View, Hitchin, Herts. Proposed by John W. Simpson, Leonard Stokes, Frank T. Baggallay.

SIMPSON: CECIL HAMILTON [A. 1909], 24 Bloomsbury Square, W.C., and 48 Luttrell Avenue, Putney, S.W.15. Proposed by William A. Pite, Harry Redfern, E. Vincent Harris.

SINCLAIR: WILLIAM BRANTON [A. 1912], Council Offices, New Malden, Surrey, and Cranford, The Crescent, Sidcup, Kent. Proposed by Edgar S. Underwood, W. E. Riley, Leslie Mansfield.

AS ASSOCIATES (19).

BARRY: CARYL ARTHUR RANSOME [S. 1912—*Special War Exemption*], Parliament Mansions, Victoria Street, S.W.1. Proposed by James Ransome, Arthur Blomfield, W. Campbell Jones.

BENNET: JAMES SPALDING [S. 1920—*Special War Exemption*], 156 Braid Road, Edinburgh. Proposed by John Watson, John Wilson, H. O. Tarbolton.

BIDDULPH-PINCHARD: CHARLES HENRY [Special War Examination], 9 Staple Inn, Holborn. Proposed by Louis Ambler, Paul Waterhouse, W. A. Forsyth.

*BRODIE: JAMES [S. 1909—*Special War Exemption*], 3 Palace View, Fulford, York. Proposed by Walter H. Brierley, James Miller, H. O. Tarbolton.

BURNET: FRANK RUSSELL [S. 1920—*Special War Exemption*], Paignton, Kilmacolm, N.B. Proposed by Wm. B. Whitie, John Keppie, George A. Boswell.

CHANT: ARTHUR GUY, P.A.S.I. [Special War Examination], 35 Spencer Street, Carlisle. Proposed by Joseph Forster, J. H. Martindale, J. W. Benwell.

*COOPER: FREDERIC ROLAND [S. 1908—*Special War Exemption*], "Southdene," Headlands, Kettering. Proposed by Albert E. Sawday, J. Alfred Gotch, F.S.A., and the Council.

FORBES: ARTHUR B. [Special War Examination], 250 Wilson Ave., N.D.G., Montreal. Proposed by Professor Percy Nobbs, F. S. Baker, Philip J. Turner.

LUNAN: LESLIE GORDON [Special War Examination], c/o H. V. Lanchester, Esq., 1 Abbot Road, Lucknow. Proposed by D. Barclay Niven, Herbert Wigglesworth, Geoffrey Lucas.

McCONNELL: LEONARD [Special War Examination], 34 Bedford Square, W.C.1. Proposed by Herbert Baker, Franklin K. Kendall, Robert Atkinson.

McEVERS: HAROLD ERIC [Special War Examination], 393 Mountain Street, Montreal, Canada. Proposed by Philip J. Turner, Professor Percy Nobbs, William Carless, O.B.E.

MACE: THOMAS HENRY [Special War Examination], 2057 Hutchison Street, Montreal. Proposed by Professor Percy Nobbs, Philip J. Turner, Kenneth G. Rea.

MERRILL: ALFRED [Special War Examination], 249 Manor Lane, Lee, S.E.12. Proposed by Robert Atkinson, E. Stanley Hall, C. E. Varndell.

MILNE: JAMES [S. 1920—*Special War Exemption*], 39 Smith Street, Hillhead, Glasgow. Proposed by Robert Miller, Andrew Black, John Keppie, A.R.S.A.

RAY: ARTHUR GORDON [Special War Examination], 495 Lansdowne Ave., Westmount, Quebec. Proposed by Geo. A. Ross, Philip J. Turner, William Carless.

TURNBULL: BERNARD WILLIAM [Special War Examination], 8 Camden Road, N.W.1. Proposed by Sir John J. Burnet, A.R.A., Robert Atkinson, Guy Church.

WEBB: JOHN ADAMS [S. 1914—*Special War Exemption*], Burton Hill, Melton Mowbray. Proposed by A. E. Sawday, Arthur Wakerley, Howard H. Thomson.

WEEKES: NORMAN BARNETT, F.S.I. [Special War Examination], Housing Department, Town Hall, Rochdale. Proposed by Professor S. D. Adshead, P. W. Hathaway and the Council.

YOUNG: THOMAS PEACH WEIR [S. 1920—*Special War Exemption*], c/o P. MacGregor Chalmers, Esq., 95 Bath Street, Glasgow. Proposed by Alexander N. Paterson, A.R.S.A., W. Hunter McNab, John Keppie, A.R.S.A.

NOTE.—The two candidates marked * have been the subject of special consideration by the Council, being put forward as special cases in accordance with recommendations Nos. 2, 3 and 4 passed at the Conference with representatives of Allied Societies on 19th January 1920, and unanimously approved by the Council on 2nd February 1920.

The Royal Gold Medallist (Architecture) 1920.

A collection of photographs illustrating the work of Monsieur Charles L. Girault, of Paris, Royal Gold Medallist 1920, is now being exhibited in the Galleries of the Royal Institute, 9 Conduit Street, W. The Exhibition is open to the public.

Paper on Cinema Design, 23rd May.

THE FOURTEENTH GENERAL MEETING of the Session will be held Monday, 23rd May, 1921, at 8 p.m., for the following purposes:—

To read the Minutes of the Meeting held 2nd May; formally to admit members attending for the first time since their election.

To read the following Paper:—

CINEMA DESIGN. By ROBERT ATKINSON [F.].

ARCHITECT'S Drawing Desk with two Double Elephant Drawers and two smaller ditto and cupboard, also Drawing Boards, T-squares, etc., stools and other office furniture for sale cheap owing to expiration of tenancy. Apply to Messrs. Houston, A.A.R.I.B.A., 4a, Bloomsbury Square, W.C.1.

MR. E. C. P. ALLEN, Student, of 2, Clifton Villas, Harold Street, Hereford, would be glad to hear from any member who has for disposal a copy of the R.I.B.A. Loan Library Catalogue, now out of print.

THE IMPERIAL WAR GRAVES COMMISSION has a vacancy for a post of Architect and Surveyor in Mesopotamia. Salary, £700 per annum; ex-service man, not over 35. Apply, The Secretary, Imperial War Graves Commission, 1, Lake Buildings (north entrance), St. James's Park, S.W.1.

THE Board of the Great Indian Peninsula Railway Co. requires an assistant to their architect on the Staff of the Chief Engineer in India. Must be an A.R.I.B.A. Duties comprise mainly the design and supervision of stations and other buildings throughout their system. Three years engagement. Salary, Rs. 600 per month. Address the Secretary, R.I.B.A., 9, Conduit Street, W.

The Committee of the "Titanic" Fund are desirous of apprenticing a lad, aged 16, to an architect. The premium would be small, but owing to the special circumstances it is hoped that some one in sympathy with the "Titanic" Fund would be willing to waive the normal premium. Address, the Secretary, R.I.B.A.

